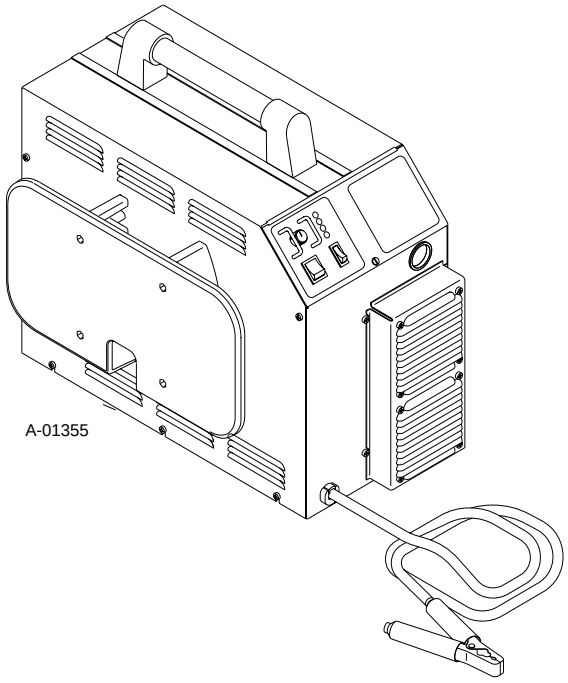
THERMAL DYNAMICS®

A THERMADYNE® Company

PAK MASTER® 100XL

200 VAC Air Plasma Cutting

Power Supply for Japan



Service Manual

August 11, 1999 **Manual No. 0-2668**

WARNING Read and understand this entire Service Manual and your employer's safety practices before installing, operating, or servicing the equipment.

WARNING While the information contained in this Service Manual represents our best judgement, Thermal Dynamics Corporation assumes no liability for its use.

Pak Master® 100XL 200 VAC Air Plasma Cutting Power Supply Service Manual for Japan, Number 0-2668

Published by:
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SECTION 1: GENERAL INFORMATION

1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.

WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

1.02 Important Safety Precautions

WARNINGS

OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.

Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.

To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.

GASES AND FUMES

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:

Antimony	Chromium	Mercury
Arsenic	Cobalt	Nickel
Barium	Copper	Selenium
Beryllium	Lead	Silver
Cadmium	Manganese	Vanadium

- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.

ELECTRIC SHOCK

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically “live” or “hot.”
- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.
- Extra care must be taken when the workplace is moist or damp.

- Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.

FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.

NOISE

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and / or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.

PLASMA ARC RAYS

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.
- Use the shade of lens as suggested in the following per ANSI / ASC Z49.1:

Arc Current	Minimum Protective Shade No.	Suggested Shade No.
Less Than 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.*

1.03 Publications

Refer to the following standards or their latest revisions for more information:

1. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
3. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126

8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

1.04 Note, Attention et Avertissement

Dans ce manuel, les mots “note,” “attention,” et “avertissement” sont utilisés pour mettre en relief des informations à caractère important. Ces mises en relief sont classifiées comme suit :

NOTE

Toute opération, procédure ou renseignement général sur lequel il importe d’insister davantage ou qui contribue à l’efficacité de fonctionnement du système.

ATTENTION

Toute procédure pouvant résulter l’endommagement du matériel en cas de non-respect de la procédure en question.

AVERTISSEMENT

Toute procédure pouvant provoquer des blessures de l’opérateur ou des autres personnes se trouvant dans la zone de travail en cas de non-respect de la procédure en question.

1.05 Precautions De Securite Importantes

AVERTISSEMENTS

L’OPÉRATION ET LA MAINTENANCE DU MATÉRIEL DE SOUDAGE À L’ARC AU JET DE PLASMA PEUVENT PRÉSENTER DES RISQUES ET DES DANGERS DE SANTÉ.

Coupant à l’arc au jet de plasma produit de l’énergie électrique haute tension et des émissions magnétique qui peuvent interférer la fonction propre d’un “pacemaker” cardiaque, les appareils auditif, ou autre matériel de santé electronique. Ceux qui travail près d’une application à l’arc au jet de plasma devrait consulter leur membre professionel de médication et le manufacturier de matériel de santé pour déterminer s’il existe des risques de santé.

Il faut communiquer aux opérateurs et au personnel TOUS les dangers possibles. Afin d’éviter les blessures possibles, lisez, comprenez et suivez tous les avertissements, toutes les précautions de sécurité et toutes les consignes avant d’utiliser le matériel. Composez le + 603-298-5711 ou votre distributeur local si vous avez des questions.

FUMÉE et GAZ

La fumée et les gaz produits par le procédé de jet de plasma peuvent présenter des risques et des dangers de santé.

- Eloignez toute fumée et gaz de votre zone de respiration. Gardez votre tête hors de la plume de fumée provenant du chalumeau.
- Utilisez un appareil respiratoire à alimentation en air si l’aération fournie ne permet pas d’éliminer la fumée et les gaz.

- Les sortes de gaz et de fumée provenant de l'arc de plasma dépendent du genre de métal utilisé, des revêtements se trouvant sur le métal et des différents procédés. Vous devez prendre soin lorsque vous coupez ou soudez tout métal pouvant contenir un ou plusieurs des éléments suivants:

antimoine	cadmium	mercure
argent	chrome	nickel
arsenic	cobalt	plomb
baryum	cuivre	sélénium
béryllium	manganèse	vanadium

- Lisez toujours les fiches de données sur la sécurité des matières (sigle américain "MSDS"); celles-ci devraient être fournies avec le matériel que vous utilisez. Les MSDS contiennent des renseignements quant à la quantité et la nature de la fumée et des gaz pouvant poser des dangers de santé.
- Pour des informations sur la manière de tester la fumée et les gaz de votre lieu de travail, consultez l'article 1 et les documents cités à la page 5.
- Utilisez un équipement spécial tel que des tables de coupe à débit d'eau ou à courant descendant pour capter la fumée et les gaz.
- N'utilisez pas le chalumeau au jet de plasma dans une zone où se trouvent des matières ou des gaz combustibles ou explosifs.
- Le phosgène, un gaz toxique, est généré par la fumée provenant des solvants et des produits de nettoyage chlorés. Eliminez toute source de telle fumée.

CHOC ELECTRIQUE

Les chocs électriques peuvent blesser ou même tuer. Le procédé au jet de plasma requiert et produit de l'énergie électrique haute tension. Cette énergie électrique peut produire des chocs graves, voire mortels, pour l'opérateur et les autres personnes sur le lieu de travail.

- Ne touchez jamais une pièce "sous tension" ou "vive"; portez des gants et des vêtements secs. Isolez-vous de la pièce de travail ou des autres parties du circuit de soudage.
- Réparez ou remplacez toute pièce usée ou endommagée.
- Prenez des soins particuliers lorsque la zone de travail est humide ou moite.
- Montez et maintenez le matériel conformément au Code électrique national des Etats-Unis. (Voir la page 5, article 9.)
- Débranchez l'alimentation électrique avant tout travail d'entretien ou de réparation.
- Lisez et respectez toutes les consignes du Manuel de consignes.

INCENDIE ET EXPLOSION

Les incendies et les explosions peuvent résulter des scories chaudes, des étincelles ou de l'arc de plasma. Le procédé à l'arc de plasma produit du métal, des étincelles, des scories chaudes pouvant mettre le feu aux matières combustibles ou provoquer l'explosion de fumées inflammables.

- Soyez certain qu'aucune matière combustible ou inflammable ne se trouve sur le lieu de travail. Protégez toute telle matière qu'il est impossible de retirer de la zone de travail.
- Procurez une bonne aération de toutes les fumées inflammables ou explosives.
- Ne coupez pas et ne soudez pas les conteneurs ayant pu renfermer des matières combustibles.
- Prévoyez une veille d'incendie lors de tout travail dans une zone présentant des dangers d'incendie.
- Le gas hydrogène peut se former ou s'accumuler sous les pièces de travail en aluminium lorsqu'elles sont coupées sous l'eau ou sur une table d'eau. NE PAS couper les alliages en aluminium sous l'eau ou sur une table d'eau à moins que le gas hydrogène peut s'échapper ou se dissiper. Le gas hydrogène accumulé explosera si enflammé.

RAYONS D'ARC DE PLASMA

Les rayons provenant de l'arc de plasma peuvent blesser vos yeux et brûler votre peau. Le procédé à l'arc de plasma produit une lumière infra-rouge et des rayons ultra-violets très forts. Ces rayons d'arc nuiront à vos yeux et brûleront votre peau si vous ne vous protégez pas correctement.

- Pour protéger vos yeux, portez toujours un casque ou un écran de soudeur. Portez toujours des lunettes de sécurité munies de parois latérales ou des lunettes de protection ou une autre sorte de protection oculaire.
- Portez des gants de soudeur et un vêtement protecteur approprié pour protéger votre peau contre les étincelles et les rayons de l'arc.
- Maintenez votre casque et vos lunettes de protection en bon état. Remplacez toute lentille sale ou comportant fissure ou rognure.
- Protégez les autres personnes se trouvant sur la zone de travail contre les rayons de l'arc en fournissant des cabines ou des écrans de protection.

- Utilisez la nuance de lentille qui est suggèrée dans le recommendation qui suivent ANSI / ASC Z49.1:

Courant Arc	Nuance Minimum Protective Numéro	Nuance Suggerée Numéro
Moins de 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** Ces valeurs s'appliquent ou l'arc actuel est observé clairement. L'experience a démontrer que les filtres moins foncés peuvent être utilisés quand l'arc est caché par moiceau de travail.*

BRUIT

Le bruit peut provoquer une perte permanente de l'ouïe. Les procédés de soudage à l'arc de plasma peuvent provoquer des niveaux sonores supérieurs aux limites normalement acceptables. Vous dú4ez vous protéger les oreilles contre les bruits forts afin d'éviter une perte permanente de l'ouïe.

- Pour protéger votre ouïe contre les bruits forts, portez des tampons protecteurs et / ou des protections auriculaires. Protégez également les autres personnes se trouvant sur le lieu de travail.
- Il faut mesurer les niveaux sonores afin d'assurer que les décibels (le bruit) ne dépassent pas les niveaux sûrs.
- Pour des renseignements sur la manière de tester le bruit, consultez l'article 1, page 5.

1.06 Documents De Reference

Consultez les normes suivantes ou les révisions les plus récentes ayant été faites à celles-ci pour de plus amples renseignements :

1. OSHA, NORMES DE SÉCURITÉ DU TRAVAIL ET DE PROTECTION DE LA SANTÉ, 29CFR 1910, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. Norme ANSI Z49.1, LA SÉCURITÉ DES OPÉRATIONS DE COUPE ET DE SOUDAGE, disponible auprès de la Société Américaine de Soudage (American Welding Society), 550 N.W. LeJeune Rd., Miami, FL 33126
3. NIOSH, LA SÉCURITÉ ET LA SANTÉ LORS DES OPÉRATIONS DE COUPE ET DE SOUDAGE À L'ARC ET AU GAZ, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. Norme ANSI Z87.1, PRATIQUES SURES POUR LA PROTECTION DES YEUX ET DU VISAGE AU TRAVAIL ET DANS LES ECOLES, disponible de l'Institut Américain des Normes Nationales (American National Standards Institute), 1430 Broadway, New York, NY 10018
5. Norme ANSI Z41.1, NORMES POUR LES CHAUSSURES PROTECTRICES, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
6. Norme ANSI Z49.2, PRÉVENTION DES INCENDIES LORS DE L'EMPLOI DE PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
7. Norme A6.0 de l'Association Américaine du Soudage (AWS), LE SOUDAGE ET LA COUPE DE CONTENEURS AYANT RENFERMÉ DES PRODUITS COMBUSTIBLES, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
8. Norme 51 de l'Association Américaine pour la Protection contre les Incendies (NFPA), LES SYSTEMES À GAZ AVEC ALIMENTATION EN OXYGENE POUR LE SOUDAGE, LA COUPE ET LES PROCÉDÉS ASSOCIÉS, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. Norme 70 de la NFPA, CODE ELECTRIQUE NATIONAL, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. Norme 51B de la NFPA, LES PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. Brochure GCA P-1, LA MANIPULATION SANS RISQUE DES GAZ COMPRIMÉS EN CYLINDRES, disponible auprès de l'Association des Gaz Comprimés (Compressed Gas Association), 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. Norme CSA W117.2, CODE DE SÉCURITÉ POUR LE SOUDAGE ET LA COUPE, disponible auprès de l'Association des Normes Canadiennes, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada, M9W 1R3
13. ivret NWSA, BIBLIOGRAPHIE SUR LA SÉCURITÉ DU SOUDAGE, disponible auprès de l'Association Nationale de Fournitures de Soudage (National Welding Supply Association), 1900 Arch Street, Philadelphia, PA 19103

14. Norme AWSF4.1 de l'Association Américaine de Soudage, RECOMMANDATIONS DE PRATIQUES SURES POUR LA PRÉPARATION À LA COUPE ET AU SOUDAGE DE CONTENEURS ET TUYAUX AYANT RENFERMÉ DES PRODUITS DANGEREUX , disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126

15. Norme ANSI Z88.2, PRATIQUES DE PROTECTION RESPIRATOIRE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018

1.07 Declaration of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: Industrial Park #2
West Lebanon, New Hampshire 03784
USA

The equipment described in this manual conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (European Council Directive 73/23/EEC as amended by Council Directive 93/68/EEC) and to the National legislation for the enforcement of this Directive.

Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

National Standard and Technical Specifications

The product is designed and manufactured to a number of standards and technical requirements among them are:

* CSA (Canadian Standards Association) standard C22.2 number 60 for Arc welding equipment.

* UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.

* ISO / IEC 60974-1 (BS 638-PT10) (EN 60 974-1) (EN50192) (EN50078) applicable to plasma cutting equipment and associated accessories.

* Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: Steve Ward
Director of Operations
Thermadyne UK
Chorley England

1.08 Statement of Warranty

LIMITED WARRANTY: Thermal Dynamics® Corporation (hereinafter "Thermal") warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal's sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows (with the exception of XL Plus Series, CutMaster 80XL , Cougar and DRAG-GUN): A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

The limited warranty period for XL Plus Series and CutMaster 80XL shall be as follows: A maximum of four (4) years from date of sale to an authorized distributor and a maximum of three (3) years from date of sale by such distributor to the Purchaser, and with the further limitations on such three (3) year period (see chart below).

The limited warranty period for Cougar and DRAG-GUN shall be as follows: A maximum of two (2) years from date of sale to an authorized distributor and a maximum of one (1) year from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

	Parts			
PAK Units, Power Supplies	**XL Plus Series & CutMaster 80XL**	**Parts Cougar/Drag-Gun**	**Parts All Others**	**Labor**
Main Power Magnetics	3 Years	1 Year	2 Years	1 Year
Original Main Power Rectifier	3 Years	1 Year	2 Years	1 Year
Control PC Board	3 Years	1 Year	2 Years	1 Year
All Other Circuits And Components Including, But Not Limited To, Starting Circuit, Contactors, Relays, Solenoids, Pumps, Power Switching Semi-Conductors	1 Year	1 Year	1 Year	1 Year
Consoles, Control Equipment, Heat Exchanges, And Accessory Equipment	1 Year		1 Year	1 Year
Torch And Leads				
Maximizer 300 Torch			1 Year	1 Year
All Other Torches	180 Days	180 Days	180 Days	180 Days
Repair/Replacement Parts	90 Days	90 Days	90 Days	None

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Dynamics® repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal warranties.

Effective May 6, 1999

SECTION 2: INTRODUCTION

2.01 Scope Of Manual

This manual provides Service Instructions for Thermal Dynamics PAK Master® 100XL 200 VAC Air Plasma Power Supply.

Refer to Operating Manual (0-2667) for individual operating procedures. Information in this edition is therefore particularly applicable to the Troubleshooting and Repair of the equipment, and is intended for use by properly-trained Service Technicians familiar with this equipment.

Read this Manual and the Operating Manual, 0-2667, thoroughly. A complete understanding of the capabilities and functions of the equipment will assure obtaining the performance for which it was designed.

2.02 General Service Philosophy

Several key points are essential to properly support the application and operation of this equipment.

A. Application

The equipment should satisfy the customer's requirements as supplied and as described in Section 3 of this manual. Be sure to confirm that the equipment is capable of the application desired.

B. Modifications

No physical or electrical modifications other than selection of standard options and Accessories are to be made to this equipment.

C. Customer/Operator Responsibilities

It is the customer / operators' responsibility to maintain the equipment and peripheral Accessories provided by Thermal Dynamics in good operating order in accordance with the procedures outlined in the Operating Manual, and to protect the equipment from accidental or malicious damage.

D. Repair Restrictions

The electronics consists of Printed Circuit Board Assemblies which must be carefully handled, and must be replaced as units. No replacement of printed circuit solder-mounted components is allowed except as noted in this manual.

If to be returned, the replaced Printed Circuit Board Assemblies must be properly packaged in protective material and returned intact per normal procedures.

2.03 Service Responsibilities

The Service Technician should be familiar with the equipment and its capabilities. He should be prepared to recommend arrangements of components which will provide the most efficient layout, utilizing the equipment to its best possible advantage.

Maintenance work should be accomplished in a timely manner. If problems are encountered, or the equipment does not function as specified, contact Technical Services Department at West Lebanon for assistance.

SECTION 3: DESCRIPTION

3.01 Scope of Manual

The information in this section has two purposes:

- To familiarize the service technician with the capabilities and limitations of the equipment
- To provide an overall understanding which will allow the technician, in turn, to properly train customer's operating personnel.

3.02 General Description

The power supply provides 70 amp maximum output and includes all control circuitry, electrical and gas inputs and outputs, pilot circuitry, torch leads receptacle and a work cable with clamp. Machine torch systems also include a remote hand ON / OFF pendant.

NOTE

The power supply can be ordered in various configurations with various options factory installed.

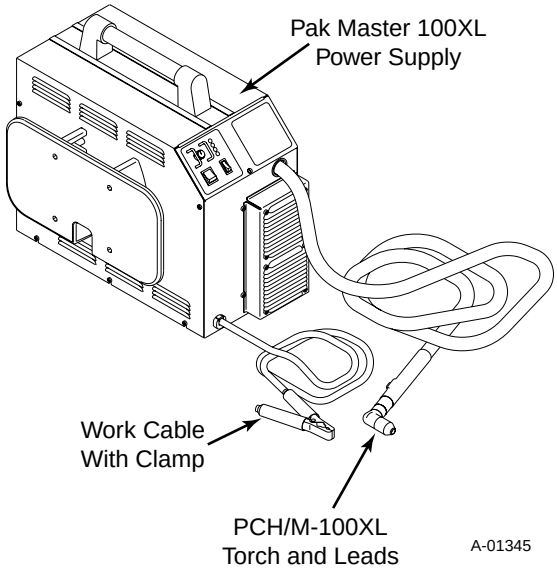


Figure 2-1 Pak Master 100XL Power Supply

The power supply is designed to work with the Model PCH / M-100XL Plasma Torches.

Torches will provide a maximum 1 inch (25.4 mm) cut capacity. Hand torches are available in 70° and 90° configurations. Machine torches are available only in Model PCM-100XL and include a rack and pinion mounting assembly. Torch leads are available in 25 ft (7.6 m), or 50 ft (15.2 m) lengths with fittings for simple installation. The torch includes a spare parts kit which provides an assortment of replacement torch parts.

NOTE

Refer to Section 3.04 for list of power supply options and accessories.

3.03 Specifications/Design Features

A. Power Supply Technical Specifications

The following specifications apply to the Power Supply only:

1. Front Panel Controls

ON / OFF Switch, RUN / SET Switch and Output Current Control

2. Front Panel LED Indicators

AC, TEMP, GAS, DC

3. Rear Panel

Input power cable strain relief, gas connection, Gas Regulator / Filter Assembly

4. Input Power

Available for the following input power:

200 VAC (±10%), 50 / 60 Hz, Single or Three-Phase

Note: Unit is supplied with 7 ft. (2.1 m) Input Power Cable.

5. Output Power

Continuously variable from 15 to 70 Amps maximum

6. Duty Cycle

40% Duty Cycle @ 108V output with 60 Hz input

40% Duty Cycle @ 108V output with 50 Hz input

7. Cut Capacity

1 inch (25.4 mm); 1 -1 / 4 inch (31.8 mm) severance

8. Pilot Circuitry

High Frequency (HF), Pulsed DC

9. Weight

79 lbs (35.8 kg)

10. Overall Dimensions

18.9" (480 mm) High x 13" (330 mm) Wide x 25.5" (648 mm) Long

Overall dimensions are with handle, lead wrap bracket, and Gas Regulator / Filter Assembly installed.

B. Gas Regulator/Filter Assembly Specifications

The following specifications apply to the Gas Regulator / Filter Assembly only:

1. Gas regulator maximum gauge pressure

160 psi (11 BAR or 11.03 kPa)

2. Maximum input gas pressure

125 psi (8.6 BAR or 861 kPa)

3. Filter

Coalescent type filter

3.04 Power Supply Options and Accessories

NOTE

Refer to Section 6, Parts Lists, for part numbers and ordering information.

The following are accessories that are available for this power supply:

A. Two Stage Air Line Filter

An optional two stage air line filter is available. The filter will remove moisture and contaminants from the air stream when using compressed air. The filter is capable of filtering to at least 5 microns. The filter assembly is pre-assembled at the factory and need only be attached to the power supply.

B. High Pressure Regulators

High pressure regulators are available for air and nitrogen. The regulators are used to set the proper pressure for the type gas being used.

C. Smart Cart

Steel cart on easy rolling 10" pneumatic tires to provide maximum mobility for the power supply. Handle is 3/4" tubing with hooks for storage of torch leads. A tie down strap is also included.

D. Interface Cable

NOTE

This accessory can be used only with the PCM-100XL Torches.

The interface cable is available in two lengths, 25 ft (7.6 m) and 50 ft (15.2 m). The cable is used to interface the power supply with an auxiliary control device to provide OK-To-Move and ON / OFF signals.

SECTION 4: SERVICE TROUBLESHOOTING DIAGNOSTICS

4.01 Introduction

This Section provides service diagnostics for the Pak Master 100XL 200VAC Power Supply, allowing the Technician to isolate any faulty Subassemblies. Refer to Section 5, Repairs & Replacement Procedures, for parts replacement instructions.

Under no circumstances are field repairs to be attempted on Printed Circuit Boards or other Subassemblies of this unit. Evidence of unauthorized repairs will void the factory warranty.

NOTE

The troubleshooting contained in this manual is for the Power Supply only. Troubleshooting other parts of the system is covered in the separate manuals for that product.

4.02 Periodic Inspection & Procedures

This subsection describes inspection procedures which should be performed at periodic intervals as required.

A. Physical Inspection

Check that all cable connections are secure.

B. Cleaning

Unit should be cleaned as described in Operating Manual 0-2667.

4.03 Common Operating Problems

WARNINGS

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

Frequently review the Important Safety Precautions (page 1). Be sure the operator is equipped with proper gloves, clothing, eye and ear protection. Make sure no part of the operator's body comes into contact with the workpiece while the torch is activated.

CAUTION

Sparks from the cutting process can cause damage to coated, painted, and other surfaces such as glass, plastic and metal.

NOTE

Handle torch leads with care and protect them from damage.

A. Piloting

Piloting is harder on parts life than actual cutting because the pilot arc is directed from the electrode to the tip rather than to a workpiece. Whenever possible, avoid excessive pilot arc time to improve parts life.

B. Torch Standoff

Improper standoff (the distance between the torch tip and workpiece) can adversely affect tip life as well as shield cup life. Standoff may also significantly affect the bevel angle. Reducing standoff generally results in a more square cut.

C. Edge Starting

For edge starts, hold the torch perpendicular to the workpiece with the front of the torch tip at the edge of the workpiece, not touching, at the point where the cut is to start. When starting at the edge of the plate, do not pause at the edge and force the arc to "reach" for the edge of the metal. Establish the cutting arc as quickly as possible.

D. Direction of Cut

The plasma gas stream swirls as it leaves the torch. The purpose of the swirl is to maintain a smooth column of gas. The swirl effect results in one side of a cut being more square than the other. Viewed along the direction of travel, the right side of the cut is more square than the left.

E. Dross

When dross is present on carbon steel, it is commonly referred to as either "high speed, slow speed, or top dross". Dross present on top of the plate is normally caused by too great a torch to plate distance. "Top dross" is normally very easy to remove and can often be wiped off with a welding glove. "Slow speed dross" is normally present on the bottom edge of the plate. It can vary from a light to heavy bead, but does not adhere tightly to the cut edge, and can be easily scraped off. "High speed dross" usually forms a narrow bead along the bottom of the cut edge and is very difficult to remove. When cutting a troublesome steel,

it is sometimes useful to reduce the cutting speed to produce "slow speed dross". Any resultant cleanup can be accomplished by scraping, not grinding.

F. Common Cutting Faults

1. Insufficient Penetration

a. Cutting speed too fast

b. Torch tilted too much

c. Metal too thick

d. Worn torch parts

e. Cutting current too low

2. Main Arc Extinguishes

a. Cutting speed too slow

b. Torch standoff too high from workpiece

c. Cutting current too high

d. Work cable disconnected

e. Worn torch parts

3. Excessive Dross Formation

a. Cutting speed too slow

b. Torch standoff too high from workpiece

c. Worn torch parts

d. Improper cutting current

4. Short Torch Parts Life

a. Oil or moisture in air source

b. Exceeding system capability (material too thick)

c. Excessive pilot arc time

d. Air flow too low (incorrect pressure)

e. Improperly assembled torch

f. Incorrect torch parts for the operation

g. Non-Genuine Thermal Dynamics parts used

4.04 Troubleshooting Guide - General Information

WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

A. Troubleshooting and Repair

Troubleshooting and repair of this unit is a process which should be undertaken only by those familiar with high voltage high power electronic equipment.

B. Advanced Troubleshooting

NOTE

For basic troubleshooting and parts replacement procedures refer to Pak Master 100XL Operating Manual 0-2581.

The advanced troubleshooting covered in this Service Manual requires Power Supply disassembly and live measurements. It is helpful for solving many of the common problems that can arise with the Pak Master 100XL Power Supply.

If major complex subassemblies are faulty, the faulty subassembly must be returned for repair.

NOTE

Follow all instructions as listed and complete each in the order presented.

Sub-section 4.09 includes specific test procedures and LED status identification tables. The sub-section is referenced by the troubleshooting guide for the specific test to be performed.

The troubleshooting guide has six sub-sections as follows:

Section 4.05 - Circuit Fault Isolation

Section 4.06 - Main Input and Internal Power Problems

Section 4.07 - Pilot Arc Problems

Section 4.08 - Main Arc Problems

Section 4.09 - Test Procedures

C. How to use the Troubleshooting Guide

The following information is a guide to help the Service Technician determine the most likely causes for various symptoms. This guide is set up in the following manner:

1. Perform operational check(s) on the equipment to isolate problem to possible circuit(s) per Section 4.05, Circuit Fault Isolation.
2. Determine symptom and isolate to defective assembly using the following format:

   X. Symptom (Bold Type)

   Any Special Instructions (Text Type)

   1. Cause (Italic Type)

   a. Check / Remedy (Text Type)

3. Locate your **symptom** in the appropriate Sub-Section.
4. **C**heck the *causes* (easiest listed first) for the **symptom**.
5. Check the remedies listed for each cause.
6. Repair as needed being sure to verify that unit is fully operational after any repairs.

NOTES

Many signals are transferred between Printed Circuit Board Assemblies on Ribbon Cables. If these cables become faulty they can then cause various problems. ***Do not*** *forget about these cables when troubleshooting.*

While troubleshooting visually inspect the internal components for signs of over heating, fractures and damage.

4.05 Circuit Fault Isolation

NOTE

Follow all instructions as listed and complete each in the order presented.

This section is to help isolate the defective circuit before troubleshooting, identify symptoms, and test the unit for proper operation. Follow the instructions as given to identify the possible symptom(s) and the defective circuit. After repairs are complete then run the following tests again to verify that the unit is fully operational.

A. Initial Setup Conditions

Connect gas supply to rear of Power Supply

Turn on gas supply and adjust Power Supply Gas Regulator to 70 psi (4.8 BAR)

Set the Power Supply controls as follows:

ON / OFF switch to OFF

RUN / SET switch to SET

CURRENT control potentiometer to maximum

B. Main Input and Internal Power Tests

Connect main AC power to the unit.

Set the Power Supply ON / OFF switch to ON and note the following:

- AC indicator blinks for six seconds, then steady ON
- Main Contactor energizes (clicks) while AC indicator is blinking
- Relay on Input PC Board energizes (clicks) after AC indicator stops blinking
- TEMP indicator OFF
- GAS indicator ON
- Gas flows
- Fans will operate
- DC lndicator is OFF

Set the Power Supply RUN / SET switch to the RUN position and note the following:

- Gas indicator goes OFF
- Gas flow stops

This completes the Main Input and Internal Power Tests. If the above are all correct then proceed to paragraph 'C'.

If the above does not function as noted then note the symptom and proceed to Section 4.06, Main Input and Internal Power Problems.

C. Pilot Arc Test

Press the torch switch to establish a pilot arc and note the following:

- Gas flows
- GAS indicator turns ON
- After preflow delay DC indicator turns ON
- Pilot arc established

This completes the Pilot Arc Test. If the above are all correct then proceed to paragraph 'D'.

If the above does not function as noted then note the symptom and proceed to Section 4.07, Pilot Arc Problems.

D. Main Arc Test

Press the Torch Switch to establish a pilot arc.

Bring the torch to within 1/8"-3/8" (3.2 - 9.5 mm) of the workpiece to establish the main cutting arc, and note the following:

- Main cutting arc initiates
- Pilot arc turns OFF

This completes the Main Arc Test. If the above are all correct then the equipment should be operating properly. If problems still persist then contact Technical Services.

If the above does not function as noted then note the symptom and proceed to Section 4.08, Main Arc Problems.

4.06 Main Input and Internal Power Problems

Locate your symptom below:

A. Main power line fuses blow as soon as main disconnect is closed

1. Faulty Input PC Board

a. Test Input PC Board per Section4.09-D; repair as necessary

B. AC indicator on front panel of power supply is OFF

1. Front Panel ON/OFF switch in OFF position

a. Place switch to ON position

2. Main power disconnect not closed

a. Close main power disconnect

3. Main power line fuses blown

a. Replace main power line Fuses

4. Defective input power cable

a. Replace input power cable

5. Fuse blown inside Power Supply

a. Replace internal Fuse (1 FU)

6. Faulty Auxiliary Transformer (refer to Appendix XI, 36 VAC Circuit Diagram)

Measure for 36 VAC on Logic PC Board from J1-1 to J1-5.

a. If voltage is not present, replace the Auxiliary Transformer

7. Faulty Logic PC Board (refer to Appendix XI, 36 VAC Circuit Diagram)

Measure for 36 VAC on Logic PC Board from J3-1 to J3-3.

a. If voltage is not present, replace the Logic PC Board

8. Faulty ON/OFF switch (refer to Appendix XI, 36 VAC Circuit Diagram)

Measure for 36vac on the Logic PC Board between J3-2 to J3-4.

a. If voltage is not present replace the ON/OFF switch

9. Faulty Logic PC Board (refer to Appendix XI, 36 VAC Circuit Diagram)

Measure for 36 VAC on Logic PC Board from J4-2 to J4-6 or J4-4 to J4-8.

a. If voltage is not present, replace the Logic PC Board

10. Faulty ribbon cable

Refer to Appendiv XI, 36 VAC Circuit Diagram and check for continuity on thepins.

a. If any line between pins is open, replace the ribbon cable

11. Faulty Gate Drive PC Board (refer to Appendix XI, 36 VAC Circuit Diagram)

Measure for 36 VAC on Gate Drive PC Board from J9-1 to J9-3.

- If voltage is not present, replace the Gate Drive PC Board
- If voltage is present,, replace Logic PC Board

C. AC indicator ON, TEMP indicator ON, System will not pilot

1. Air flow through unit is restricted

a. Provide adequate air flow (Refer to Operating Manual 0-2581, Section 3.02)

2. Exceeded duty cycle of Power Supply

a. Wait for fans to cool unit and refer to Operating Manual 0-2581, Section 2.03, for proper Duty Cycle

3. Faulty Fan or Logic PC Board

Measure for 115 VAC on the Logic PC Board from J2-2 to J2-8 and J2-3 to J2-9.

- If voltage is correct, replace Fan Assembly
- If voltage is incorrect, replace Logic PC Board

4. Faulty temperature circuit

a. Check temperature circuit per Section 4.09-F; repair as necessary

D. AC indicator ON; TEMP indicator ON; System will pilot (RUN/SET switch must be in RUN)

1. Open Ribbon Cable or faulty FET/Heatsink Assembly

Check continuity on Logic Ribbon Cable from J4-10 (Logic PC Board) to J6-10 (FET / Heatsink Assembly)

- If cable has open, replace ribbon cable
- If cable has continuity, replace FET / Heatsink Assembly

2. Defective Logic PC Board

On Logic PC Board jumper J4 pin 9 to J4 pin 10

a. If TEMP indicator stays ON then replace Logic PC Board

E. AC indicator ON; TEMP indicator OFF; No gas flow; GAS and DC indicators OFF

1. RUN/SET switch in RUN position

a. Switch to SET position

2. Gas supply not connected to unit

a. Connect to gas supply

3. Gas supply not turned on

a. Turn gas supply on

4. Faulty RUN/SET switch

a. Check continuity

5. Faulty gas solenoid circuit

a. Test gas solenoid circuit per Section 4.09-G; repair as necessary

F. AC indicator ON; GAS indicator OFF; Gas flows; DC indicator OFF

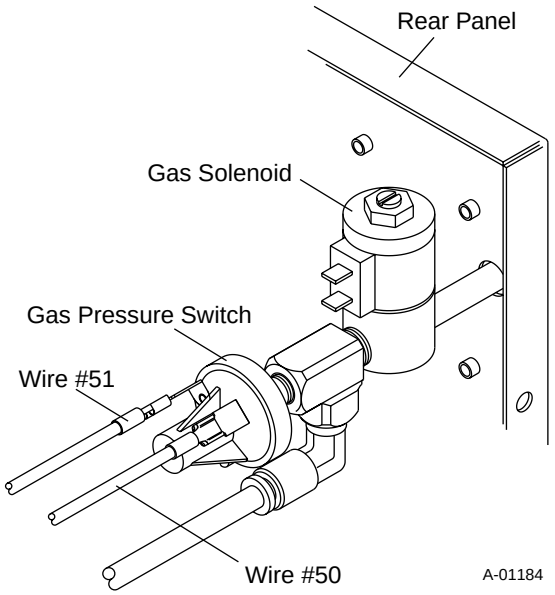
1. Gas pressure to low

a. See torch manual for operating pressures

2. Faulty pressure switch

Measure for DC voltage from wire #51 to wire #50 at the gas pressure switch at the rear of the Rear Panel Assembly.

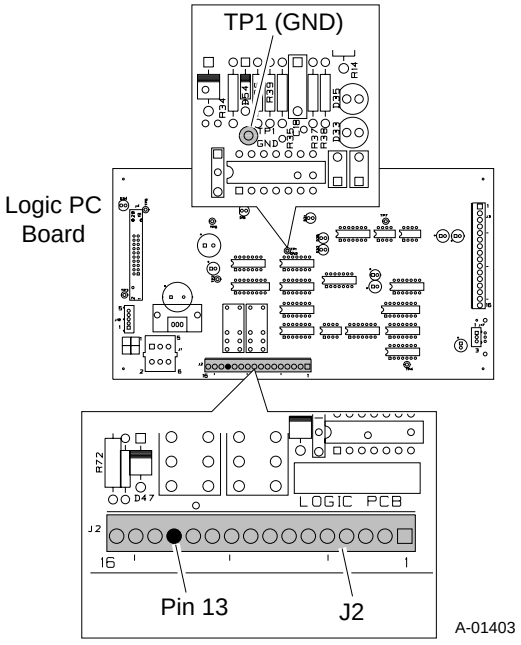
a. If 12vdc and pressure is above 50 PSI, replace gas pressure switch.



5. Faulty Wiring or Logic PC Board

Check for DC voltage from Logic PC Board J2-13 to TP1 (GND)

- If less than a volt, replace Logic PC Board



G. AC indicator ON; Gas flows; GAS and DC indicators ON; Arc in torch without pressing torch switch

1. Faulty torch switch

a. Refer to appropriate Torch Instruction Manual and check continuity

2. Faulty torch leads

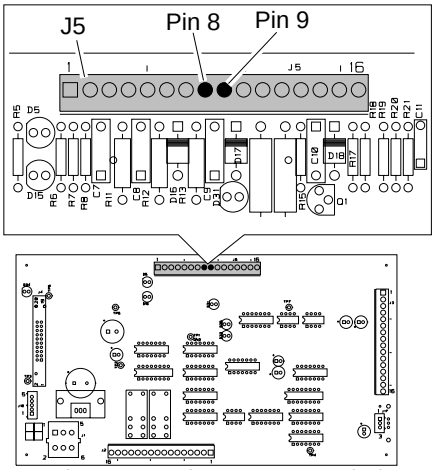
a. Refer to appropriate Torch Instruction Manual and check continuity

3. Faulty Logic or Pilot PC Board

Disconnect the Torch Control Cable from the J22 connector.

Check for dc voltage from Logic PC Board J5 pin 8 to J5 pin 9.

a. Replace Logic PC Board if voltage is 15 vdc

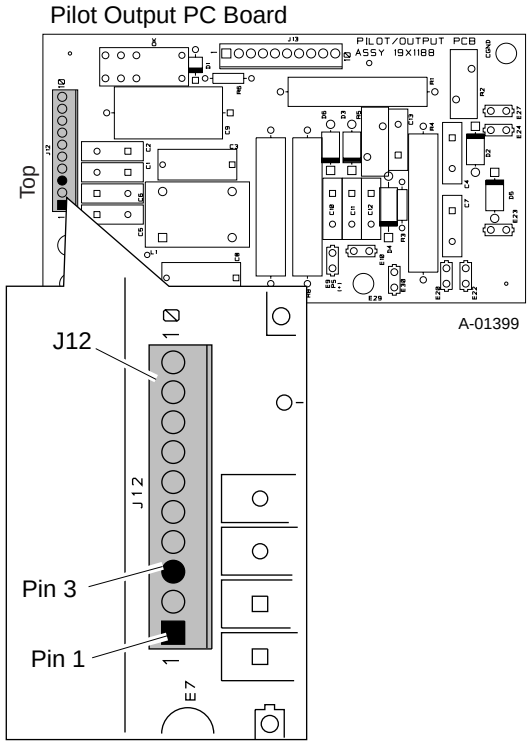


4. Faulty Pilot Output PC Board

Remove power from the power supply. Disconnect J12 and J13 from the Pilot PC Board.

Check for an open between J12 pin 1 to J12 pin 3 on the Pilot Output PC Board.

a. Replace Pilot Output PC Board if continuity is present



4.07 Pilot Arc Problems

Locate your symptom below:

A. AC indicator ON; No gas flow; GAS and DC indicators OFF (Torch Switch must be pressed)

1. RUN/SET switch in SET position

a. Place RUN / SET switch to RUN position

2. Faulty RUN/SET switch

a. Check switch and replace if necessary

3. *Faulty hand torch parts or Logic PC Board*

Check torch switch enable indicator, D5, on the Logic PC Board.

a. If indicator D5 is ON, torch shield cup and switch are okay.

b. If Torch Switch Enable indicator D5 on Logic PC Board is OFF check the following:

Check Pilot / Output PC Board for 12 VDC between J12 pin 1 to pin 3 with torch switch pressed.

- If voltage is correct, replace Torch parts as needed per appropriate Torch Instruction Manual

- If voltage is incorrect, replace Logic PC Board

5. Faulty Logic PC Board

Check CD enable indicator, D15, on the Logic PC Board. If OFF, on Logic PC Board check for 12 VDC between J5 pins 8 to 9 with torch switch pressed.

a. Replace Logic PC Board if less than 1 VDC is present

B. AC indicator ON; Gas flows; GAS indicator ON; DC indicator blinks; Small arc may be visible in torch

1. Faulty Pilot Output PC Board or Shorted Torch

a. Test per Section 4.09-H; repair as necessary

2. Faulty FET/Heatsink Assembly

a. Check per Section 4.09-I; repair as necessary

3. Faulty torch

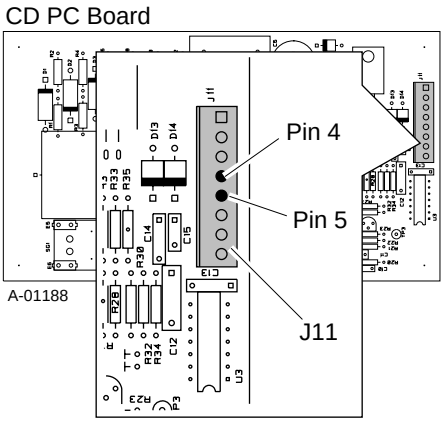
a. Check torch per appropriate Torch Instruction Manual

C. AC indicator ON; Gas flows; GAS and DC indicators ON; No arc in torch; No arc at spark gap on CD PC Board; CD enable indicator (D15) on CD PC Board ON

1. Faulty CD PC Board

Measure DC voltage between J11-4 to J11-5 on CD PC Board

a. If voltage is less than 2 vdc replace CD PC Board



D. AC indicator ON; Gas flows; GAS and DC indicators ON; Spark at gap on CD PC Board and CD enable indicator (D15) on Logic PC Board ON; No arc or intermittent arc in torch

1. Gas pressure(s) set incorrectly (too high)

a. Refer to appropriate Torch Manual

2. Oil/moisture in air lines

a. Purge system. If problem corrected add filters in line with air source

3. Incorrect torch parts

a. Refer to appropriate Torch Instruction Manual

4. Faulty leads

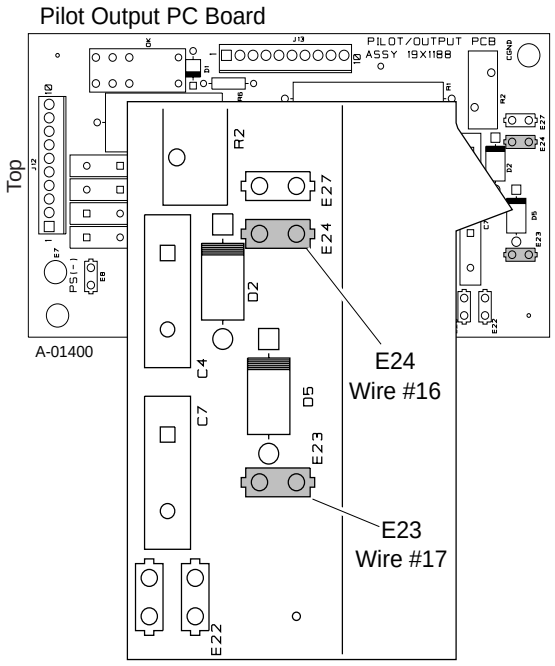
a. Check continuity per appropriate Torch Instruction Manual

5. Faulty torch

a. Check continuity per appropriate Torch Instruction Manual

6. Faulty connection of wire #16 or #17 to Pilot Output PC Board

a. Check wiring connection



7. Faulty Logic PC Board

Measure for 15 VDC on Logic PC Board from J5-6 to J5-7.

a. If voltage is less than 10 VDC, replace Logic PC Board

8. Faulty PCR Relay

Install a jumper between wires #12 and #14. Retry piloting again.

a. If torch pilots with jumper installed, replace PCR Relay

4.08 Main Arc Problems

Locate your symptom below:

A. Main cutting arc will not initiate

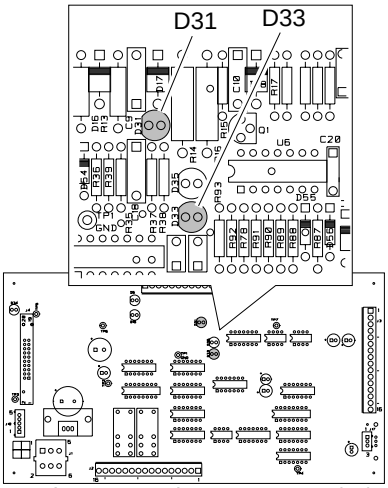
1. Work cable not connected.

a. Connect work cable.

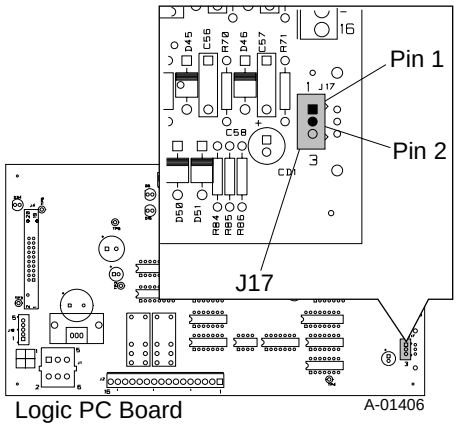
2. Faulty current sensor

Check the following indicators inside the Power Supply:

- Pilot indicator (D33) on the Logic PC Board is ON during pilot then OFF during main arc transfer
- CSR indicator (D31) on the Logic PC Board is OFF during pilot then ON during main arc transfer



While trying to transfer measure voltage at J17-1 to J17-2 on the Logic PC Board.



If voltage is approximately 12 vdc replace the current sensor.

If voltage is less than 2 vdc replace the Logic PC Board.

B. When operating at amperages over 35 amps the amperage drops off after main cutting arc initiates

Check the following indicator inside the Power Supply:

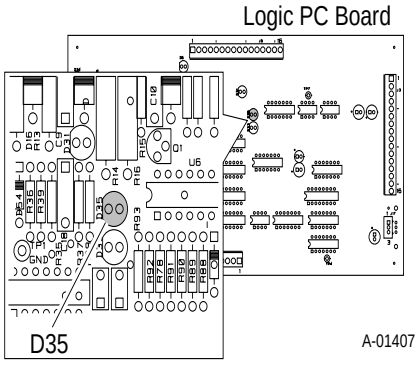
- Drag indicator (D35) on the Logic PC Board is ON when the torch tip comes in contact with the workpiece.

1. Cutting tip in contact with the workpiece.

a. Maintain standoff distance 1/8"-3/8" between cutting tip and workpiece.

2. Faulty Logic PC Board

If torch tip is off the workpiece and the drag indicator, D35, on the Logic PC Board is still ON, then replace the Logic PC Board



4.09 Test Procedures

The test procedures in this subsection are referenced in the troubleshooting section.

A. Safety Precautions

1. Significant DC Voltage exists after removal of input power. Allow 2 minutes for discharge time. Voltage measured on input capacitors must be zero before performing service on the power supply.
2. Do Not touch electrical components with any part of the human body when power is applied.
3. Keep away from any moving parts.
4. Hot surfaces can cause severe burns. Allow equipment to cool before servicing.
5. Electrostatic discharge can damage printed circuit board assemblies. Transport printed circuit boards in proper anti-static shielded packages. Use proper grounding techniques with wrist strap before handling printed circuit boards.
6. Misaligned plugs can cause printed circuit board damage. Be sure plugs are properly aligned and completely seated.
7. Excessive pressure can damage printed circuit board. Use only minimal pressure and gentle movement when disconnecting or connecting printed circuit board plugs.

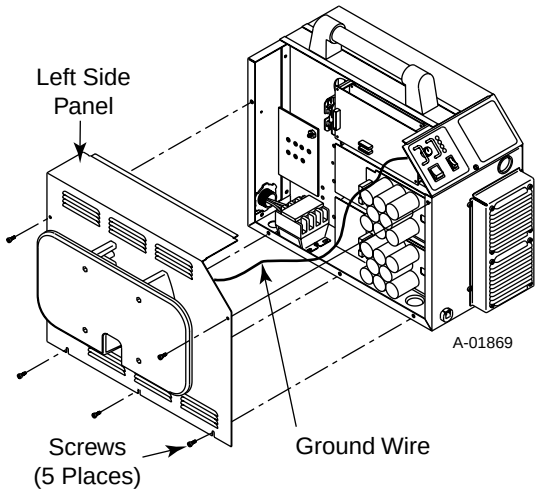
B. Opening Power Supply Enclosure

The left side panel of the Power Supply must be removed to gain access to the input power connections and the input voltage selection.

WARNING

Disconnect primary power at the source before assembling or disassembling the Power Supply, torch parts, or torch and leads assemblies.

1. Using a phillips head screw driver remove the five screws which secure the left side panel (viewed from front of unit) to the frame assembly.



2. Carefully pull the left side panel from the Power Supply a short distance (see note).

NOTE

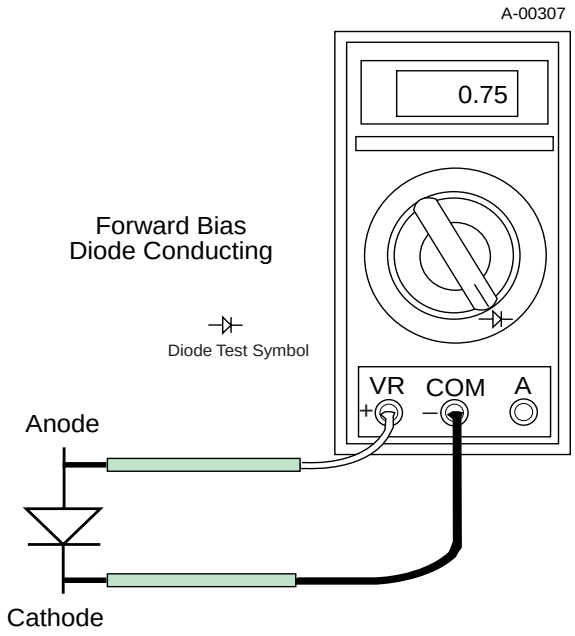
There is a ground wire attached to the side panel.

3. Remove the nut securing the ground wire to the side panel.
4. Close the enclosure by reversing the above steps.

C. Diode Testing Basics

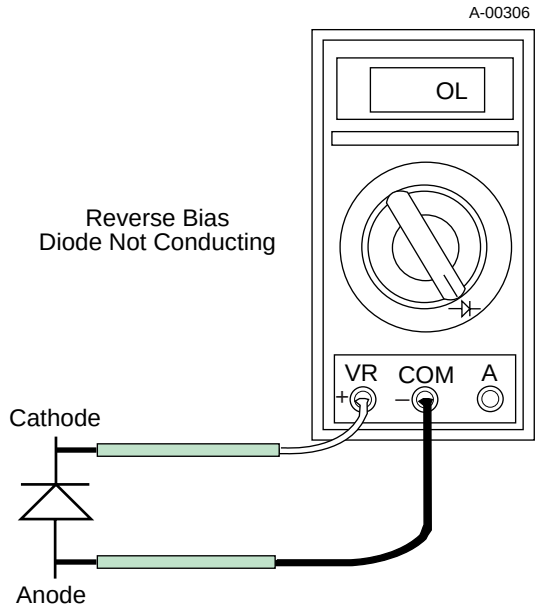
Testing of diode modules requires a digital volt / ohmmeter that has a diode test scale. Remember that even if the diode module checks good, it may still be bad. If in doubt, replace the diode module.

1. Locate the diode module to be tested.
2. Remove cables from mounting studs on diodes to isolate the module.
3. Set digital volt / ohmmeter to diode test scale.
4. Using the Figures for each test, check each diode in the module. Each diode must be checked in forward bias (plus to negative) and reverse bias (negative to plus) direction.
5. Connect the volt / ohmmeter positive lead to the anode (+) of the diode and the negative lead to the cathode (-) of the diode for forward bias testing (refer to following figure). A properly functioning diode will conduct in the forward bias direction and indicate between 0.3 to 0.9 volts.



Testing Diode Forward Bias

6. Reverse the meter leads across the diode for reverse bias testing (refer to following figure). A properly functioning diode will block in the reverse bias direction and depending on the meter function will indicate an open or "OL".



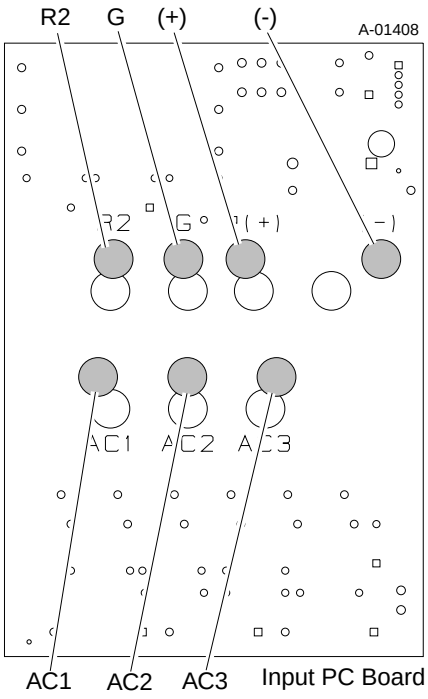
Testing Diode Reverse Bias

7. If a diode checks bad, replace the diode module.

8. Reconnect all cables to proper terminals.

D. Input PC Board Test

Check Input PC Board for shorted input diode.



Remove AC power and with an ohmmeter set on the diode range make the following checks:

Meter (+)	Meter (-)	Indication
AC1	R2	Diode Drop
R2	AC1	Open
AC2	R2	Diode Drop
R2	AC2	Open
AC3	R2	Diode Drop
R2	AC3	Open
AC1	(-)	Open
(-)	AC1	Diode Drop
AC2	(-)	Open
(-)	AC2	Diode Drop
AC3	(-)	Open
(-)	AC3	Diode Drop

The meter should indicate a diode drop in one direction and an open in the other direction for each check.

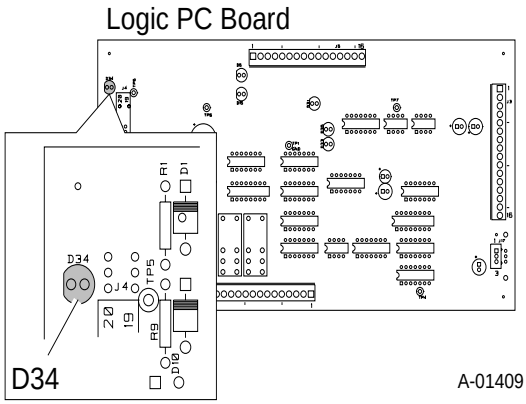
If Input Bridge Diode is shorted, make the following checks with an ohmmeter at the Main Contactor:

Meter (+)	Meter (-)	Indication
L1	T1	Open
L2	T2	Open
L3	T3	Open

If any test has resistance, then replace the Main Contactor also.

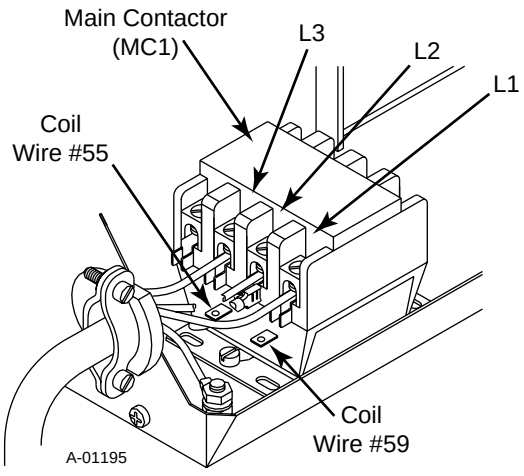
E. Main Contactor (MC1) Test

Reconnect power and observe proper start-up procedure. Indicator D34 on the Logic PC Board should be ON. If indicator D34 is OFF there is no voltage to the Power Supply or an overvoltage condition exists.



If indicator D34 is OFF check for proper AC input voltage per the following:

- **Three Phase Units** check L1, L2, and L3



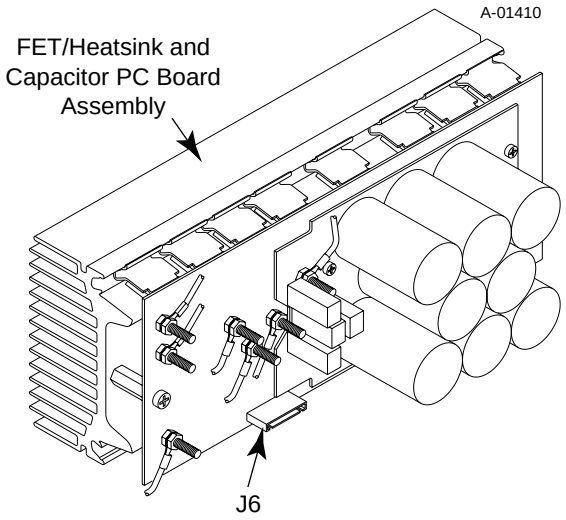
Measure voltage on coil of contactor, approximately 117 VAC between wires #55 and #59.

- If voltage is correct, replace Main Contactor.
- If voltage is incorrect, replace Logic PC Board.

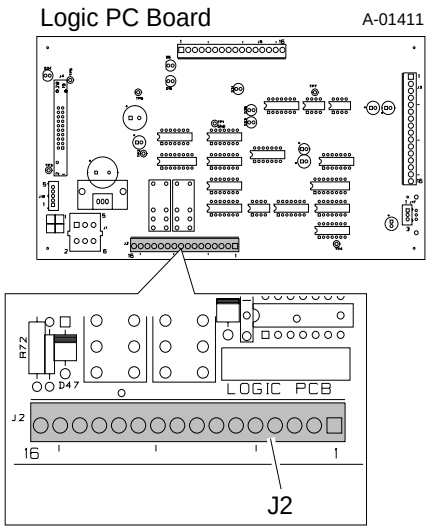
F. Temperature Circuit Test

Test the temperature circuit per the following:

1. Place the front panel ON / OFF switch to the OFF position.
2. Disconnect ribbon cable from the Upper FET / Heatsink Assembly at J6.

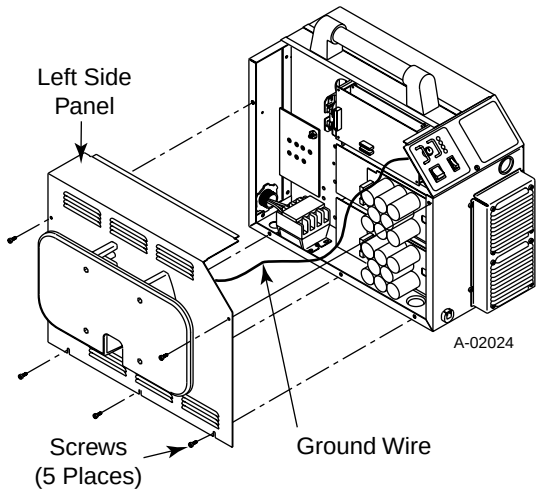


3. Place the front panel ON / OFF switch to ON.
4. Check status of the TEMP indicator. If indicator has gone OFF, then remove power and replace the Upper FET / Heatsink Assembly.
5. Place the front panel ON / OFF switch to the OFF position.
6. Disconnect ribbon cable from the Lower FET / Heatsink Assembly at J6.
7. Place the front panel ON / OFF switch to ON.
8. Check status of the TEMP indicator. If indicator has gone OFF, then remove power and replace the Lower FET / Heatsink Assembly.
9. Place the front panel ON / OFF switch to the OFF position.
10. Disconnect wiring cable from the Logic PC Board at J2-15.



11. Place the front panel ON / OFF switch to ON.

12. Check status of the TEMP indicator. If indicator has gone OFF, then remove power and replace the Temperature Switch Assembly next to the input bridge diode.

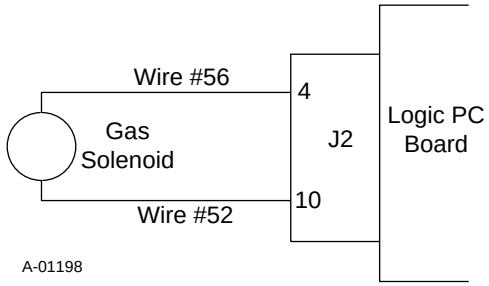


13. Reconnect the ribbon cables to the Upper and Lower FET / Heatsink Assemblies at J6.

14. If the front panel TEMP indicator is still ON, replace the Logic PC Board.

G. Gas Solenoid Circuit Test

Make the following voltage checks per the circuit diagram and replace the faulty part as required.



1. Check for 115 VAC from Wire #56 to wire #52 at the gas solenoid.

   If approximately 115 VAC replace solenoid.

   If no voltage is present proceed to Step 2.

2. Measure for 115 VAC from J2-4 to J2-10 at the Logic PC Board.

   If voltage is not correct replace Logic PC Board.

H. Pilot Arc Circuit

Check across E23 to E24 at the Pilot Output PC Board. There should be a diode drop across E23 to E24 in one direction and an open in the other.

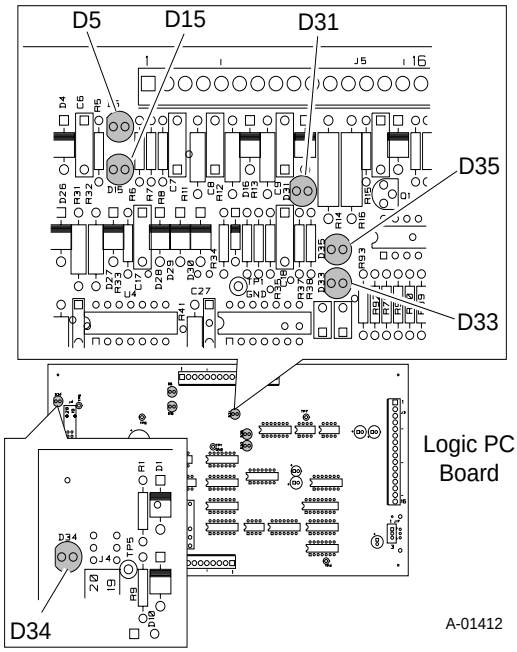
If shorted remove the wires at E23 and E24 at the Pilot Output PC Board and check again.

Replace Pilot Output PC Board if shorted from E23 to E24 (with wires #17 and #16 removed).

I. FET/Heatsink Circuit Tests

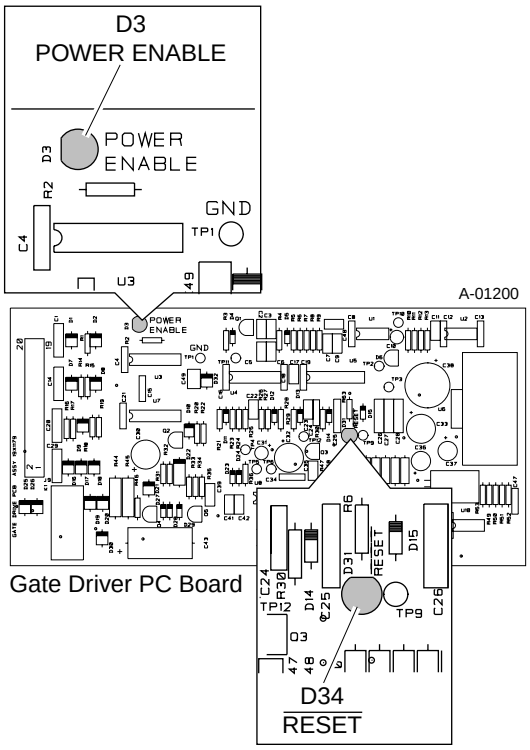
The FET / Heatsink circuit tests require various checks to isolate the possible fault to the FET / Heatsink Assembly. There are several internal indicators (LED's) on both the Logic PC Board and the Gate Drive PC Board to help in troubleshooting.

The indicators on the Logic PC Board as follows:



Indicator	Meaning
D5	Torch Switch Enable - When ON indicates torch switch is pressed.
D15	CD Enable - Initiates spark gap on CD PC Board. Indicator should come ON then go OFF after a pilot arc has been established.
D31	CSR - Indicates main cutting arc is established.
D33	Pilot ON - Indicates that a true pilot arc has started. OFF during cutting.
D34	AC OK - When ON indicates that AC Input voltage is okay.
D35	Drag On - When ON indicates that the torch tip is making contact with the workpiece.

The indicators on the Gate Drive PC Board as follows:



Indicator	Meaning
D3	Power Enable - When ON PWM Enable received from the Logic PC Board.
D31	Reset - Indicator will blink if primary over-current is detected when torch switch is pressed.

1. No DC Output

An open circuit voltage of approximately 280 to 325 VDC (depending on input power selected) is produced when switching transistors in the FET/ Heatsink Assemblies are turned ON by a PWM Enable signal from the Logic PC Board. A circuit on the Logic PC Board monitors the output voltage. When the output voltage drops below 60 VDC, indicating a problem exists, the Logic PC Board sends a signal which turns OFF the PWM Enable signal to the Gate Drive PC Board. Because this happens in less than 50 milliseconds, it is not easy to take voltage readings to find the source of the problem.

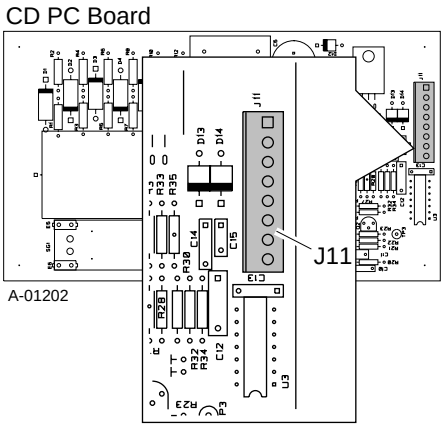
When the unit is at “idle” the AC OK indicator, D34, should be ON. The Torch Switch Enable indicator, D5, turns ON when the torch switch is pressed. At

this point the gas begins to flow. When the preflow time is over the PWM Enable signal is given and the DC indicator at the front panel turns ON. When the pilot arc is established the Pilot On indicator, D33, turns ON.

If the PWM Enable indicator, D3, does not come ON then replace the Logic PCB.

If the PWM Enable indicator, D3, turns ON then OFF immediately, the following test should be performed:

a. Disconnect J11 from the CD PC Board to disable the CD signal.

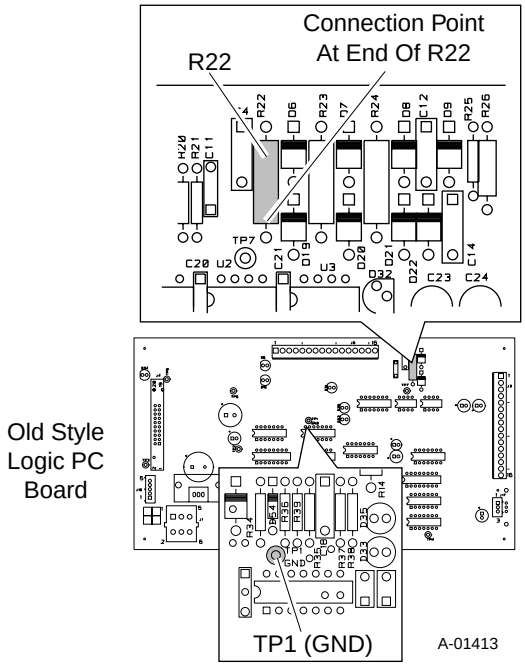


b. Connect a jumper between TP1 and one of the following points depending on the style of the Logic PC Board in the unit:

NOTE

To determine the style of the Logic PC Board note the location of R22 or TP8.

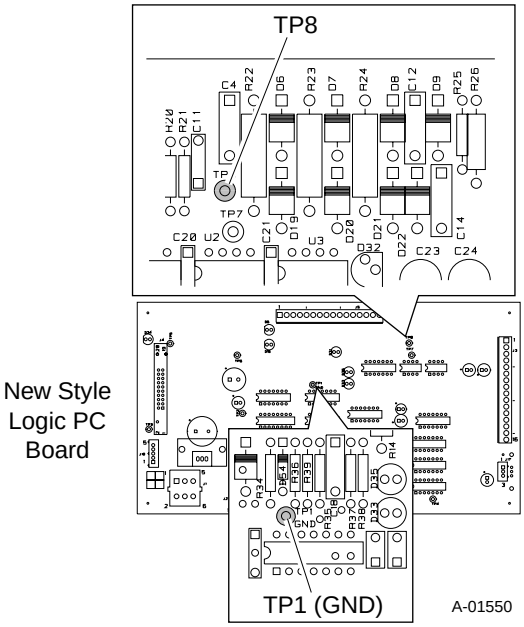
- **Style #1 - Use Lower side of R22**



NOTE

The conformal coating must be removed from the lead of R22 for the jumper to make a good contact.

- **Style #2 - Use TP8**



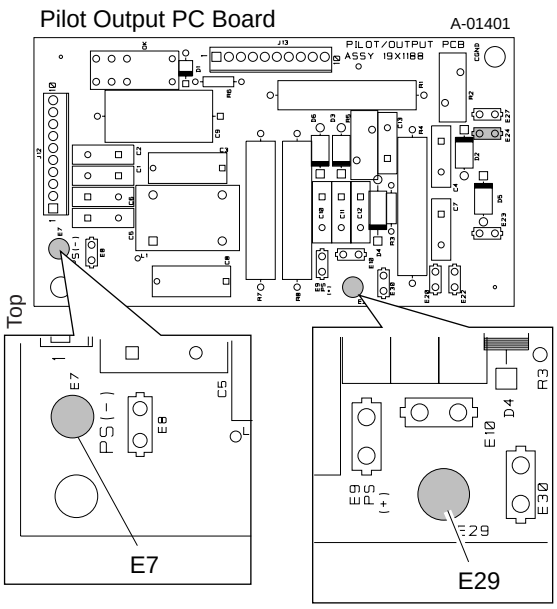
This will cause the gas to flow continuously and the DC indicator on the front panel to turn ON.

WARNING

Connector J11 on the CD PC Board must be disconnected to prevent electrical damage to measuring equipment when testing the open circuit voltage (OCV).

c. Press and hold the hand torch switch (Logic PC Board Torch Switch Enable indicator, D5, turns ON).

d. Measure open circuit voltage between E29 (+) to E7 (-) at the Pilot Output PC Board. If voltage is low, each FET/Heatsink Assembly should be tested individually.



2. FET/Heatsink Output Diode Checks

Remove input power from the unit.

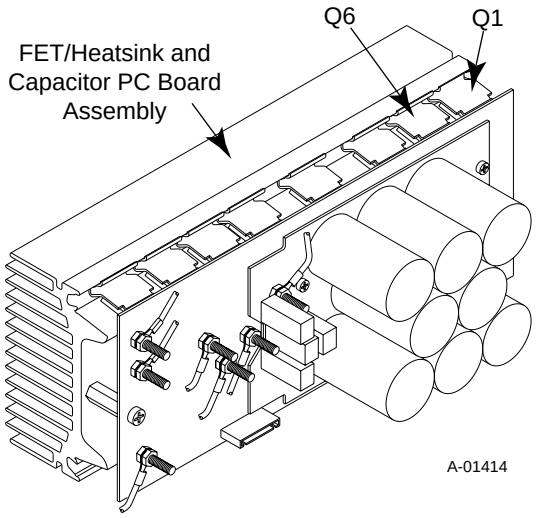
Isolate each FET / Heatsink Assembly by removing the red wire #12 at E18 and the black wire #11 at E17 on each FET / Heatsink Assembly. With an ohmmeter set on the diode range, check between the two output studs, E17 (- output) to E18 (+ output). This should indicate a diode drop in one direction and open in the other.

If the checks indicate open or shorted in both directions then the faulty Fet / Heatsink Assembly should be replaced.

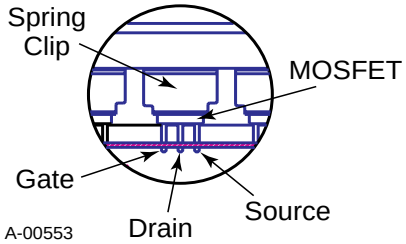
3. MOSFET Resistance Checks

The Power Supply contains two identical FET / Heatsink Assemblies. On each assembly there are two MOSFET devices that must be checked. Use an ohmmeter to check for the proper resistance of the MOSFET's per the following procedure:

a. Locate Q1 and Q6 on the FET / Heatsink Assembly.



b. Place the meter (+) lead on gate lead of Q1 and meter (-) lead on source lead of Q1. The meter should indicate approximately 2.5K ohms.



c. Place the meter (+) lead on drain lead of Q1 and meter (-) lead on source lead of Q1. The meter should indicate >100K ohms.

NOTES

Make measurements near the body of each MOSFET.

Be sure that the meter lead probes penetrate the protective coating on the MOSFET.

d. Place the meter (+) lead on drain lead of Q1 and meter (-) lead to the heatsink. The meter should indicate >1 meg ohms.

e. Place the meter (+) lead on gate lead of Q6 and meter (-) lead on source lead of Q6. The meter should indicate approximately 2.5K ohms.

f. Place the meter (+) lead on drain lead of Q6 and meter (-) lead on source lead of Q6. The meter should indicate >100K ohms.

4. FET Reset Diode Check

Use an ohmmeter set to the diode function and check the reset diode per the following procedure:

a. Place the meter (+) lead on E14 and the meter (-) lead on E25 of the FET / Heatsink Assembly Capacitor PC Board to check the reset diode. The meter should indicate between 0.4 to 0.6 volts using the diode function.

b. Reverse the meter leads and the indication should be a capacitor charging.

c. Place the meter (-) lead on E14 and the meter (+) lead on E26 of the FET / Heatsink Assembly Capacitor PC Board to check the reset diode. The meter should indicate between 0.4 to 0.6 volts using the diode function.

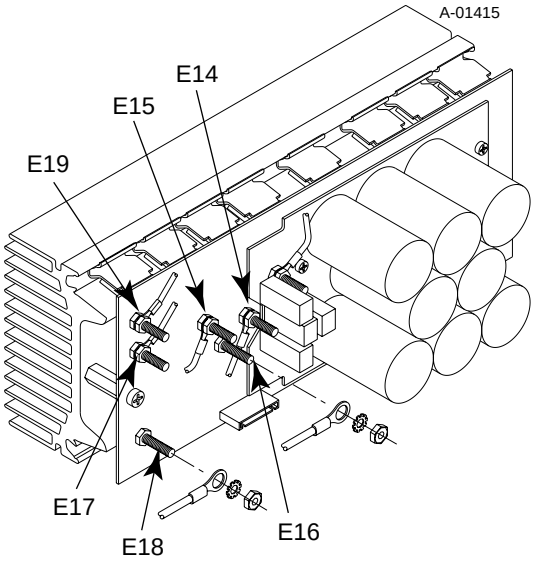
d. Reverse the meter leads and the indication should be a capacitor charging.

If the indication is a short, then replace the FET / Heatsink Assembly.

5. FET Output Rectifier Check

Use a digital meter, diode or ohms function, to check the forward and reverse bias of the output rectifiers on the FET / Heatsink Assemblies per the following procedure:

a. Remove the wire from E16 and E18 on the Upper and Lower FET / Heatsink Assemblies.



b. Place the meter (+) lead on E16 and the meter (-) lead on E18 of the FET / Heatsink Assembly to check the output rectifier forward bias. The meter should indicate between 0.3 to 0.6 volts using the diode function or 100K ohms using the ohms function.

c. Place the meter (+) lead on E18 and the meter (-) lead on E16 of the FET / Heatsink Assembly to check the output rectifier reverse bias. The meter should indicate 'OL' using the diode function or 100K ohms using the ohms function.

d. Place the meter (+) lead on E17 and the meter (-) lead on E19 of the FET / Heatsink Assembly to check the output rectifier forward bias. The meter should indicate between 0.3 to 0.6 volts using the diode function or 100K ohms using the ohms function.

e. Place the meter (+) lead on E19 and the meter (-) lead on E17 of the FET / Heatsink Assembly to check the output rectifier reverse bias. The meter should indicate 'OL' using the diode function or 100K ohms using the ohms function.

f. Place the meter (+) lead on E18 and the meter (-) lead on the heatsink of the FET / Heatsink Assembly to check the output rectifier resistance to ground. The meter should indicate >1 meg ohms.

Replace the FET / Heatsink Assembly if any of the above tests are open or shorted.

6. FET Output Clamp Diodes Check

Use an ohmmeter to check the resistance of the output clamp diodes, (+ out) E17 and (- out) E18, per the following procedure:

NOTE

The wires on E16 and E18 should still be disconnected from both FET/Heatsink Assemblies.

a. Place the meter (+) lead on E17 and the meter (-) lead on E18 of the FET / Heatsink Assembly to check the output clamp diode resistance. The meter should indicate >1 meg ohms.

b. Place the meter (+) lead on E18 and the meter (-) lead on E17 of the FET / Heatsink Assembly to check the output clamp diode resistance. The meter should indicate >1 meg ohms.

Replace the FET / Heatsink Assembly if any of the above tests are open or shorted.

SECTION 5: REPAIRS & REPLACEMENT PROCEDURES

5.01 Introduction

This Section describes parts replacement procedures and all cable repairs which may be performed on the Pak Master 100XL 200VAC Power Supply.

Under no circumstances are field repairs to be attempted on Printed Circuits or other Subassemblies of this unit. Evidence of unauthorized repairs may void the factory warranty.

5.02 Anti-Static Handling Procedures

A. General

CAUTION

PC boards can be irreparably damaged by improper handling due to electrostatic discharge (ESD).

Replacement PC boards are shipped in a protective enclosure to prevent damage from electrostatic discharge (ESD) during shipping. Included with each replacement board is a ground strap to prevent static damage during installation.

WARNINGS

Read and understand these instructions and the instructions on the grounding wrist strap package before opening the equipment enclosure or removing the replacement PC board from its protective enclosure.

Disconnect primary power to the system before disassembling the torch, torch leads, or power supply enclosure.

Do not operate the equipment or test equipment under power while wearing the grounding wrist strap.

B. Procedure

1. Open the wrist strap and unwrap the first two folds of the band. Wrap the adhesive side firmly around your wrist.
2. Unroll the rest of the band and peel the liner from the copper foil at the opposite end.
3. Attach the copper foil to a convenient and exposed electrical ground.
4. Connect the equipment primary cable ground to the same electrical ground as the wrist strap.
5. Open the equipment enclosure (see instruction manual for the appropriate equipment) and remove the failed PC board.
6. Carefully open the ESD protective bag and remove the replacement PC board.
7. Install the replacement PC board in the equipment and make all necessary connections.
8. Place the failed PC board in the ESD protective bag and seal for return shipping.
9. Reassemble the equipment enclosure (see instruction manual for the appropriate equipment).
10. Remove the grounding wrist strap from your wrist and from the electrical ground connection before reconnecting primary power to the equipment.

5.03 Parts Replacement - General Information

The parts replacement procedures described in this manual, except for filter replacement, require that the Power Supply be disassembled. The part to be replaced will determine to what extent the Power Supply must be disassembled.

NOTES

Before removing any connection mark each wire with the connection designation. When reassembling make sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when reassembling the unit.

Each Subsection is referenced to Section 6 for parts lists and overall detailed drawing.

WARNING

Disconnect primary power from the source before opening or disassembling the power supply. Make sure AC indicator on the Power Supply front panel is OFF.

Before disassembling any part of the Power Supply first read the procedure for the part to be replaced, then proceed with the disassembly.

5.04 Major External Parts Replacement

NOTE

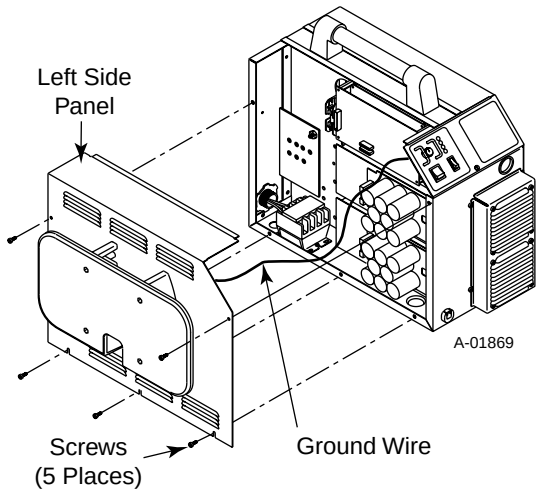
Refer to Section 6.03 for parts list and overall detail drawing.

A. Lifting Handle Replacement

1. Remove the two allen screws securing the ends of the handle to the top of the unit.
2. Remove the Lifting Handle from the two end mounting blocks.
3. Place the replacement Lifting Handle into the mounting blocks.
4. Secure the Lifting Handle to the top of the unit with the two allen screws.

B. Left Side Panel Replacement

1. Using a phillips head screwdriver remove the five screws which secure the Left Side Panel to the Frame Assembly.



2. Carefully pull the Left Side Panel up and away from the unit far enough to gain access to the ground wire connection on the inside of the panel.
3. Remove the nut from the ground stud on the side panel and remove the ground wire.
4. Remove the four screws securing the Leads Wrap to the old Left Side Panel.
5. Install the replacement Left Side Panel by reversing the above procedure noting the following:
   - Leads Wrap must be installed on the replacement Left Side Panel before panel is installed.
   - Place the Left Side Panel onto the frame and slide the top edge under the lip on the top of the Right Side Panel.

C. Right Side Panel Replacement

1. Remove the Lifting Handle per paragraph 'A' above.
2. Unlock the latch for the Access Panel.
3. Using a phillips head screwdriver remove the five screws which secure the Right Side Panel to the Frame Assembly.

NOTE

The three bottom screws need only be loosened to allow the panel to be removed.

4. Carefully pull the Right Side Panel up and away from the unit far enough to gain access to the wire connections on the inside of the Access Panel.
5. Disconnect the LED/POT PC Board wiring connector from J3 at the Logic PC Board.
6. Remove the two nuts securing the Access Panel to the Right Side Panel.
4. Install the replacement Right Side Panel by reversing the above procedure noting the following:
   a. Install the Access Panel onto the replacement Right Side Panel.
   b. Place the Right Side Panel onto the frame and slide the lip on the top edge over the edge on the top of the Left Side Panel.

D. Leads Wrap Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the four screws securing the Leads Wrap to the Left Side Panel.
4. Install the replacement Leads Wrap by reversing the above procedure.

5.05 Access Panel Parts Replacement

NOTE

Refer to Section 6.04 for parts list and overall detail drawing.

A. CURRENT Knob Replacement

1. Turn the CURRENT adjustment fully counter clockwise and note the location of the pointer on the knob.
2. Loosen the screw securing the Current Knob to the potentiometer shaft.
3. Remove the old knob.
4. Place the replacement Current Knob on to the potentiometer shaft with the location of the pointer the same as noted in step 1.
5. Tighten the screw to secure the knob to the potentiometer shaft.

B. ON/OFF Switch Replacement

1. Unlatch the Access Panel to gain access to the rear of the ON / OFF Switch.
2. Disconnect all the wiring to the ON / OFF Switch.
3. Squeeze the top and bottom of the switch while pulling it out of the Access Panel
4. Install the replacement ON / OFF Switch by reversing the above procedure.

C. RUN/SET Switch Replacement

1. Unlatch the Access Panel to gain access to the rear of the RUN / SET Switch.
2. Disconnect all the wiring to the RUN / SET Switch.
3. Squeeze the top and bottom of the switch while pulling it out of the Access Panel
4. Install the replacement RUN / SET Switch by reversing the above procedure.

D. Pot/LED PC Board Assembly Replacement

1. Turn the CURRENT adjustment fully counter clockwise and note the location of the pointer on the knob.
2. Loosen the screw securing the Current Knob to the potentiometer shaft.
3. Remove the Current Knob.
4. Unlatch the Access Panel to gain access to the Pot / LED PC Board.
5. Remove the Pot / LED PC Board from the four standoffs.
6. Disconnect the connector at J14 of the Pot / LED PC Board.
7. Install the replacement Pot / LED PC Board by reversing the above procedure.

E. Access Panel Replacement

1. Remove the Right Side Panel per Section 5.04-C.
2. Remove the following components from the Access Panel:
   - Current Knob per paragraph 'A' above.
   - ON / OFF Switch per paragraph 'B' above.
   - RUN / SET Switch per paragraph 'C' above.
   - Pot / LED PC Board per paragraph 'D' above.
3. Remove the two nuts and washers securing the Access Panel to the Right Side Panel.
4. Install the replacement Access Panel by reversing the above procedure.

5.06 Front Panel Parts Replacement

NOTE

Refer to Section 6.05 for parts list and overall detail drawing.

A. Work Cable Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Work Cable connection from the lower FET / Heatsink Assembly at E18 (OUTPUT) terminal.
3. Remove the Work Cable strain relief from the Front Panel .
4. Pull the Work Cable from the unit.
5. Install the replacement Work Cable by reversing the above procedure.

B. Current Sensor Replacement

1. Remove the Work Cable per paragraph 'A' above.
2. Disconnect the ribbon cable from the Current Sensor at J17 of the Logic PC Board.
3. Remove the four screws securing the sensor to the standoffs at the rear of the Front Panel, behind the Work Cable Strain Relief.
4. Install the replacement Current Sensor by reversing the above procedure.

C. Main Contactor Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Note the orientation of all the wires and then disconnect the input and output wiring from the Main Contactor Assembly.
3. Remove the two nuts and washers securing the Main Contactor to the bottom of the unit.
4. Install the replacement Main Contactor Assembly by reversing the above procedure.

D. Fan Replacement

1. Remove the Left Side Panel per Section 5.04-B.

NOTE

The Top and Bottom Fan Assemblies are replaced in the same manner.

2. Remove the four screws, one each corner, securing the Fan Guard to the Front Panel.
3. Pull the Fan Guard and Fan Assemblies from the Front Panel far enough to locate the wiring to the Fans.
4. Note the orientation of the Fan Assembly wiring push on connectors.
5. Carefully pull the wiring connectors from the lugs on the Fan Assembly.
6. Locate and remove the four phillips head screws securing the Fan Assembly to the Fan Guard.
7. Carefully pull the Fan Assembly from the Fan Guard.
8. Install the replacement Fan Assembly by reversing the above procedure (see NOTE).

NOTE

The mounting holes in the replacement Fan Assembly are not tapped. Using one of the screws removed in Step 6 above, turn the screw into the mounting holes of the new Fan Assembly. This will make the reassembly of the unit easier.

E. Unit Base/Front Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Right Side Panel per Section 5.04-C.
3. Remove the Work Cable per paragraph "A' above.
4. Remove the Torch from the unit.
5. Remove the two Fan Assemblies from the Base/Front Panel Assembly per paragraph 'D' above.
6. Remove the following hardware:
   a. Two mounting nuts from Main Contactor Assembly.
   b. Nut and wire from ground stud.
   c. Bottom two screws securing Rear Panel to Base/Front Assembly.
   d. On the right side remove the two screws securing the Pilot Panel to the Base/Front Panel Assembly.
   e. On the right side remove the three nuts and washers securing the internal chassis to the bottom of the unit.
7. At the front panel remove the two screws securing the Base/Front Panel to the internal chassis.
8. Carefully slide the internal components up, back, and out of the Base/Front Assembly.
9. Install the replacement Base/Front Assembly by reversing the above procedure.

5.07 Left Side Internal Component Parts Replacement

NOTE

Refer to Section 6.06 for parts list and overall detail drawing.

A. Fuse Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Fuse from the fuse holder.
3. Replace the Fuse with 0.8A 600V fuse.
4. Reinstall the Left Side Panel.

B. Fuse Holder Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the Fuse from the holder.
3. Disconnect the two wires connected to the Fuse Holder.
3. Remove the two small screws securing the Fuse Holder to the chassis.
4. Install the replacement Fuse Holder by reversing the above procedure.

C. Input PC Board Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-B.
2. Remove the five screws securing the wiring to the Input PC Board.

3. Remove the clear Input PC Board Insulator sheet.

4. Remove the two screws at 'R2' and 'G'.

5. Carefully pull the Input PC Board from the unit far enough to disconnect the wiring connections to the component side of the PC board.

6. Install the replacement Input PC Board by reversing the above procedure noting the following:

NOTE

Failure to properly tighten the seven screws securing the Input PC Board to the Diode Bridge will cause damage to the unit.

- The five screws securing the wiring and Input PC Board to the Diode Bridge must be tight enough to prevent the wires from moving.
- The two screws securing the Input PC Board to the Diode Bridge at 'R2' and 'G' must be tight.

D. Input Diode Bridge Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-B.

2. Remove the Right Side Panel per Section 5.04-C.

3. Remove the Input PC Board per paragraph 'C' above.

4. Remove the two nuts securing the Input Diode Bridge to the Center Chassis.

5. Remove the Input Diode Bridge Assembly from the unit.

6. Remove the Thermal Pad from the Center Chassis.

7. Remove the Input Heatsink on the right side of the unit.

8. Remove the Thermal Pad from the Input Heatsink.

9. Install the replacement Input Diode Bridge Assembly and new Thermal Pad by reversing the above procedure (see Note).

NOTE

The two nuts removed in Step 3 must be torqued to 35 in-lbs when reinstalled.

E. Logic PC Board Replacement

1. Remove the Left Side Panel per Section 5.04-B.

2. Carefully remove all cable connections from the Logic PC Board noting the location of each.

3. Remove the four screws securing the Logic PC Board to the standoffs.

4. Install the replacement Logic PC Board by reversing the above procedure.

F. Gate Driver PC Board Replacement

1. Remove the Left Side Panel per Section 5.04-B.

2. Remove the Logic PC Board per paragraph 'E' above.

3. Carefully remove all cable connections to the Gate Driver PCB Assembly noting the location of each per the following chart:

Connection	Description of Cable
J9	Ribbon Cable from Logic PC Board
J8	Ribbon Cable from Top FET/Heatsink Assembly
J7	Ribbon Cable from Bottom FET/Heatsink Assembly

4. Remove the four screws securing the Gate Driver PC Board to the four standoffs.

5. Reinstall the replacement Gate Driver PCB Assembly by reversing the above procedure.

G. FET/Heatsink Assembly Replacement

NOTE

The two FET/Heatsink Assemblies are identical and are removed in the same manner.

1. Remove the Left Side Panel per Section 5.04-B.

2. Place the unit on its right side.

3. Remove the Ribbon Cable plug at J6 on the FET / Heatsink Assembly. To remove the cable, push down on the locking tab and pull the cable plug out of the connector.

4. Disconnect all the wire lug connections to the FET / Heatsink Assembly.

Connection	Description
E14	Main Transformer (Primary)
E15	Main Transformer (Primary)
E16	Main Transformer (Secondary)
E17	(-) Output
E18	(+) Output
E19	Main Transformer (Secondary)
E25	(+) From Input Section Assembly
E26	(-) From Input Section Assembly

5. Disconnect the wiring from wire lug connections on the Capacitor PC Board at '+' and '-' terminals.
6. Remove the two screws securing the Heatsink Mounting Bracket to the chassis.
7. Lift up on the middle where the two FET / Heatsink Assemblies come together and remove the Mounting Bracket.
8. Slide the FET / Heatsink Assembly out and up to remove the FET / Heatsink Assembly from the unit.
9. Install the replacement FET / Heatsink Assembly by reversing the above procedure.

NOTE

Be sure that the top groove in the FET/Heatsink Assembly is properly seated over the cutout in the chassis.

5.08 Rear Panel Parts Replacement

NOTE

Refer to Section 6.07 for parts list and overall detail drawing.

A. Two Stage Air Line Filter Replacement

NOTE

This part is an option and may not be installed on all units.

1. Disconnect the gas supply hose from the IN side of the Two Stage Filter Assembly.
2. Pull the Two Stage Filter Assembly out of the mounting bracket.
3. Disconnect the output hose from the OUT side of the assembly.
4. Install the replacement Two Stage Filter Assembly by reversing the above procedure.

B. Pressure Switch Replacement

1. Remove the Right Side Panel per Section 5.04-C.
2. Disconnect the two wires connected to the Pressure Switch Assembly.
3. Remove the assembly from the T-fitting.
4. Install the replacement Pressure Switch Assembly by reversing the above procedure and noting the following:
   - Apply pipe thread sealant to the fitting before reassembling.

C. Solenoid Valve Replacement

1. Remove the Right Side Panel per Section 5.04-C.
2. Disconnect the two wires connected to the Pressure Switch Assembly.
3. Disconnect the two wires connected to the Solenoid Valve Assembly.
4. Disconnect the gas tube connected to the bottom of the T-fitting.
5. Remove the T-fitting and gas fitting from the Solenoid Valve Assembly.
6. Remove the Solenoid Valve Assembly from the straight brass fitting.
7. Install the replacement Solenoid Valve Assembly by reversing the above procedure.

D. Air Line Regulator Bracket Replacement

1. Disconnect the gas input hose from the input of the Air Line Regulator Assembly.
2. Remove the nut securing the Air Line Regulator to the mounting bracket.
3. Remove the four screws securing the Air Line Regulator Bracket to the Rear Panel.
4. Pull the bracket from the unit.
5. Install the replacement Air Line Regulator Bracket by reversing the above procedure.

E. Air Line Regulator Replacement

1. Disconnect the gas input hose from the input of the Air Line Regulator Assembly.
2. Remove the Right Side Panel per Section 5.04-C.

3. Disconnect the gas tube connected to the bottom of the T-fitting at the Solenoid Valve Assembly.

4. Remove the Air Line Regulator Bracket per paragraph 'D' above.

5. Pull the Air Line Regulator away from the Rear Panel far enough to disconnect the plumbing joint between the reducer and elbow fitting..

6. Remove the elbow fitting from the old assembly.

7. Install the replacement Air Line Regulator Assembly by reversing the above procedure and noting the following:

   • Apply pipe thread sealant to the fitting before reassembling.

5.09 Right Side Internal Component Parts Replacement

NOTE

Refer to Section 6.08 for parts list and overall detail drawing.

A. Pilot/Output PC Board Assembly Replacement

1. Remove the Right Side Panel per Section 5.04-C.

NOTES

Before removing any connection mark each wire with the connection designation. When reassembling this makes sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when reassembling the unit.

2. Disconnect all the wiring connections to the Pilot / Output PC Board Assembly.

3. Remove the four screws and washers securing the PC Board to the standoffs.

4. Install the replacement Pilot / Output PC Board Assembly by reversing the above procedure.

B. CD PC Board Assembly Replacement

1. Remove the Right Side Panel per Section 5.04-C.

NOTES

Before removing any connection mark each wire with the connection designation. When reassembling this makes sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when reassembling the unit.

2. Disconnect all the wiring connections to the CD PC Board Assembly.

3. Remove the four screws and washers securing the PC Board to the standoffs.

4. Install the replacement CD PC Board Assembly by reversing the above procedure.

C. Relay Replacement

1. Remove the Right Side Panel per Section 5.04-C.

NOTES

Before removing any connection mark each wire with the connection designation. When reassembling this makes sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when reassembling the unit.

2. Disconnect all the wiring connections to the Relay Assembly.

3. Remove the two screws securing the Relay Assembly to the Pilot Panel.

4. Install the replacement Relay Assembly by reversing the above procedure.

D. Main Transformer Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-B.

2. Remove the Right Side Panel per Section 5.04-C.

3. Remove the following terminal connections from the two FET / Heatsink Assemblies noting the location of each wire:

Connection	Description
E14	MAIN XFMR PRI
E15	XFMR PRI
E16	MAIN XFMR SEC
E19	XFMR SEC

4. Remove the four screws which hold the mounting plate to the bottom chassis.

5. Carefully remove the mounting plate with the Main Transformer Assembly from the unit.

6. Install the replacement Main Transformer Assembly by reversing the above procedure.

NOTE

The four screws securing the mounting plate to the chassis should have a maximum of 2 to 5 threads protruding through the left side of the chassis.

E. Output Inductor Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-B.

2. Remove the Right Side Panel per Section 5.04-C.

3. Disconnect the lead wire on terminal E7 of the Pilot Output PC Board.

4. Disconnect the lead wire on terminal E17 of the top FET / Heatsink Assembly.

5. Remove the four mounting screws securing the Output Inductor Assembly to the chassis.

6. Remove the Output Inductor Assembly from the unit.

7. Install the replacement Output Inductor Assembly by reversing the above procedure

NOTE

The four screws securing the mounting plate to the chassis should have a maximum of 2 to 5 threads protruding through the left side of the chassis.

F. Auxiliary Transformer Assembly Replacement

1. Remove the Left Side Panel per Section 5.04-B.

2. Remove the Right Side Panel per Section 5.04-C.

3. Disconnect the single pin connector on the white wire coming from the Auxiliary Transformer Assembly.

4. On the voltage selection panel remove the pin 13 from connectors J19 (black wire), J20 (orange wire), and J21 (brown wire) using a pin removal tool .

5. Disconnect the secondary wires by unplugging the J15 connector from the Logic PC Board.

6. Remove the four mounting screws securing the Auxiliary Transformer Assembly to the chassis.

7. Remove the Auxiliary Transformer Assembly from the unit.

8. Install the replacement Auxiliary Transformer Assembly by reversing the above procedure noting the following:

   - Brown wire to 460V selector connector (J21) on the voltage selection panel.
   - Orange wire to 380V selector connector (J20) on the voltage selection panel.
   - Black wire to 220V selector connector (J19) on the voltage selection panel.

G. Bulkhead Adapter Replacement

1. Remove the Right Side Panel per Section 5.04-C.

2. Remove Torch connection at the Bulkhead Adapter.

3. Disconnect the gas tube from the fitting at the end of the Bulkhead Adapter.

4. Remove the fitting.

5. Remove the first nut from the Bulkhead Adapter.

6. Carefully remove the wire from the Bulkhead Adapter that comes from the CD Transformer Coil.

7. Remove the second nut securing the Bulkhead Adapter to the bulkhead.

8. Install the replacement Bulkhead Adapter by reversing the above procedure.

SECTION 6: PARTS LISTS

6.01 Introduction

A. Parts List Breakdown

The parts lists provide a breakdown of all replaceable components. The parts lists are arranged as follows:

Section 6.03 Major External Replacement Parts List

Section 6.04 Access Panel Replacement Parts List

Section 6.05 Front Panel Replacement Parts List

Section 6.06 Left Side Internal Component Replacement Parts List

Section 6.07 Rear Panel Replacement Parts List

Section 6.08 Right Side Internal Component Replacement Parts List

Section 6.09 Options and Accessories

NOTE

Parts listed without item numbers are not shown, but may be ordered by the catalog number shown.

B. Returns

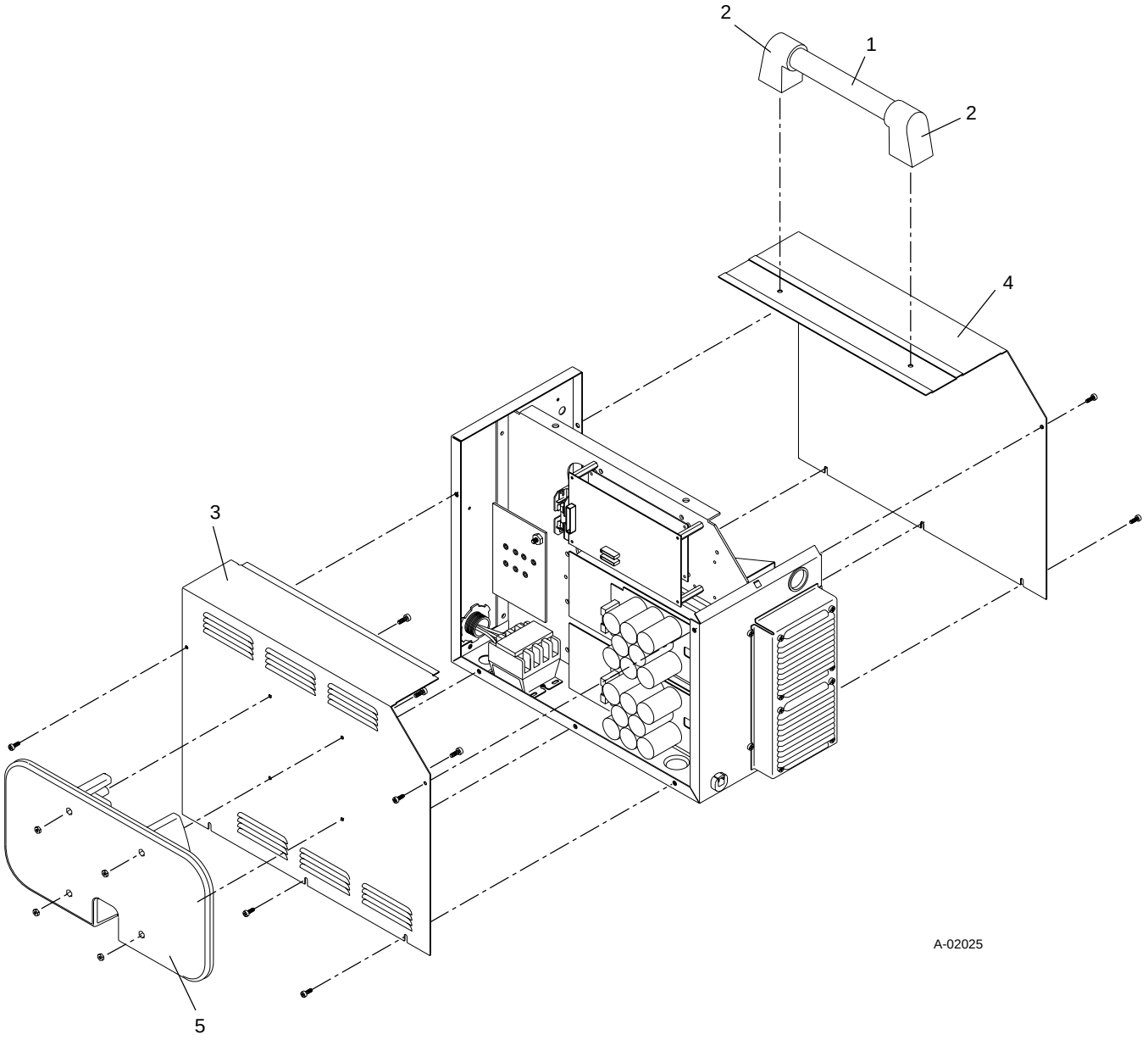
If a Thermal Dynamics product must be returned for service, contact your Thermal Dynamics distributor. Materials returned to Thermal Dynamics without proper authorization will not be accepted.

6.02 Ordering Information

Order replacement parts by catalog number and complete description of the part or assembly, as listed in the parts list for each type item. Also include the model and serial number of the torch. Address all inquiries to your authorized Thermal Dynamics distributor.

6.03 Major External Replacement Parts List

Item #	Qty	Description	Catalog #
1	1	TUBE, LIFTING HANDLE, 1.125 OD, 11.85 LG	9-7505
2	2	MOUNT, LIFTING HANDLE	9-7506
3	1	COVER, LEFT SIDE Includes:	9-7610
		COVER, LEFT SIDE, 2X2976	
		LABEL, USER WARNING, ENGLISH	
4	1	COVER, RIGHT SIDE Includes:	9-7609
		COVER, RIGHT SIDE	
		OVERLAY, RIGHT SIDE PANEL	
		LABEL, USER WARNING, FRENCH	
5	1	LEADS WRAP Includes:	9-7611
		PANEL, LEADS WRAP	
		OVERLAY, LEFT SIDE PANEL	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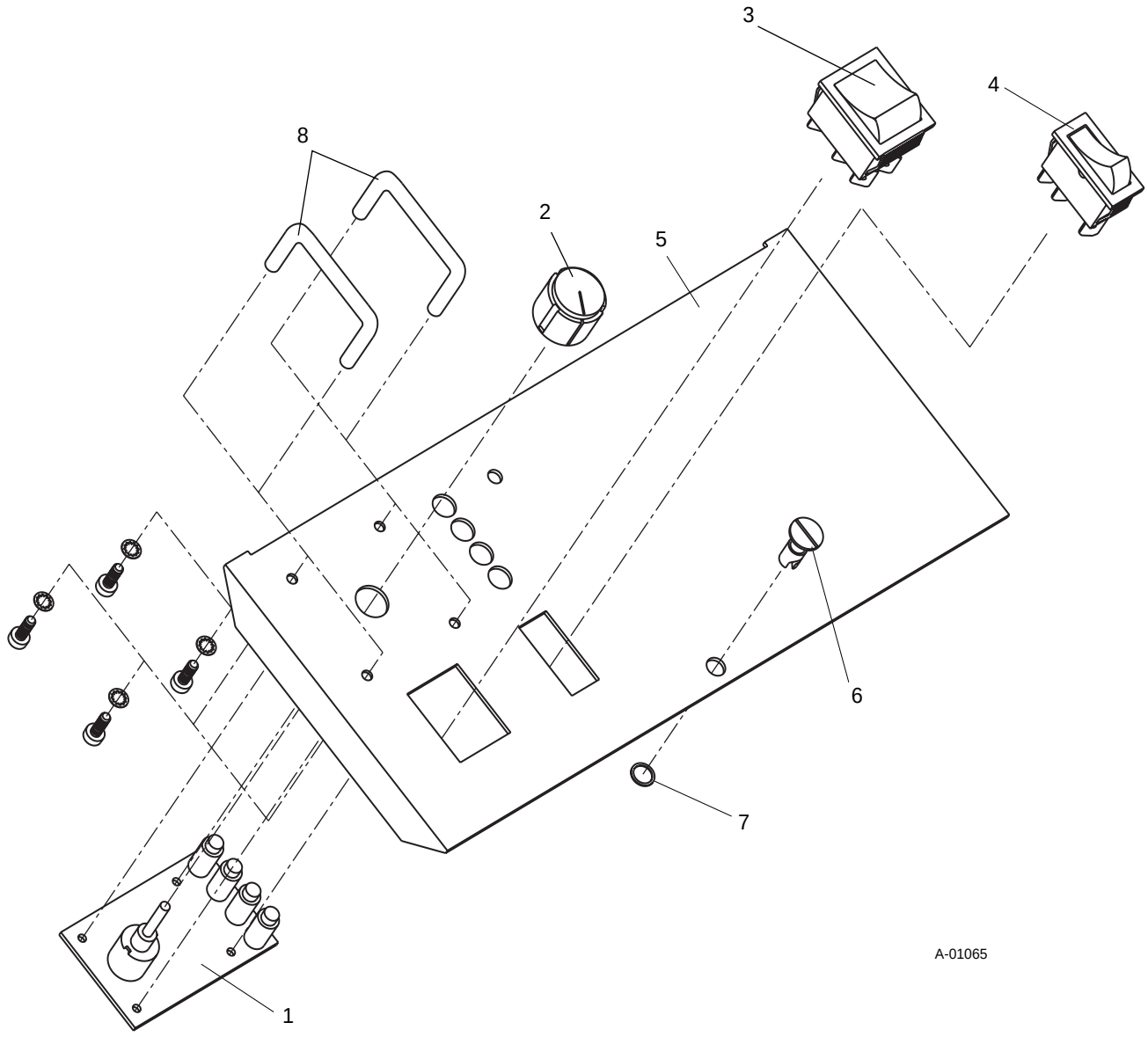
6.04 Access Panel Replacement Parts List

Item #	Qty	Description	Catalog #
1	1	ASSEMBLY, POT / LED PCB Replacement Kit (PC Board & Knob)	9-7014
2	1	KNOB, INNER CONCENTRIC	
		Current Pot Shaft Diameter 1 / 8 inch - Order Kit	9-7014
		Current Pot Shaft Diameter 1 / 4 inch - Knob Only	9-8007
3	1	ON / OFF ROCKER SWITCH, DPST	8-3258
4	1	SWITCH, ROCKER, SPST	9-1042
5	1	PANEL, ACCESS Includes:	9-7608
		PANEL, ACCESS	
		OVERLAY, ACCESS PANEL	
		LABEL, ACCESS PANEL	
6	1	“DZUS” STUD	9-4346
7	1	“DZUS” RETAINING RING	9-4347
8	1	POT, PROTECTOR KIT Includes:	7-7575
	2	Handles	
	2	Screws	
	2	Star Washers	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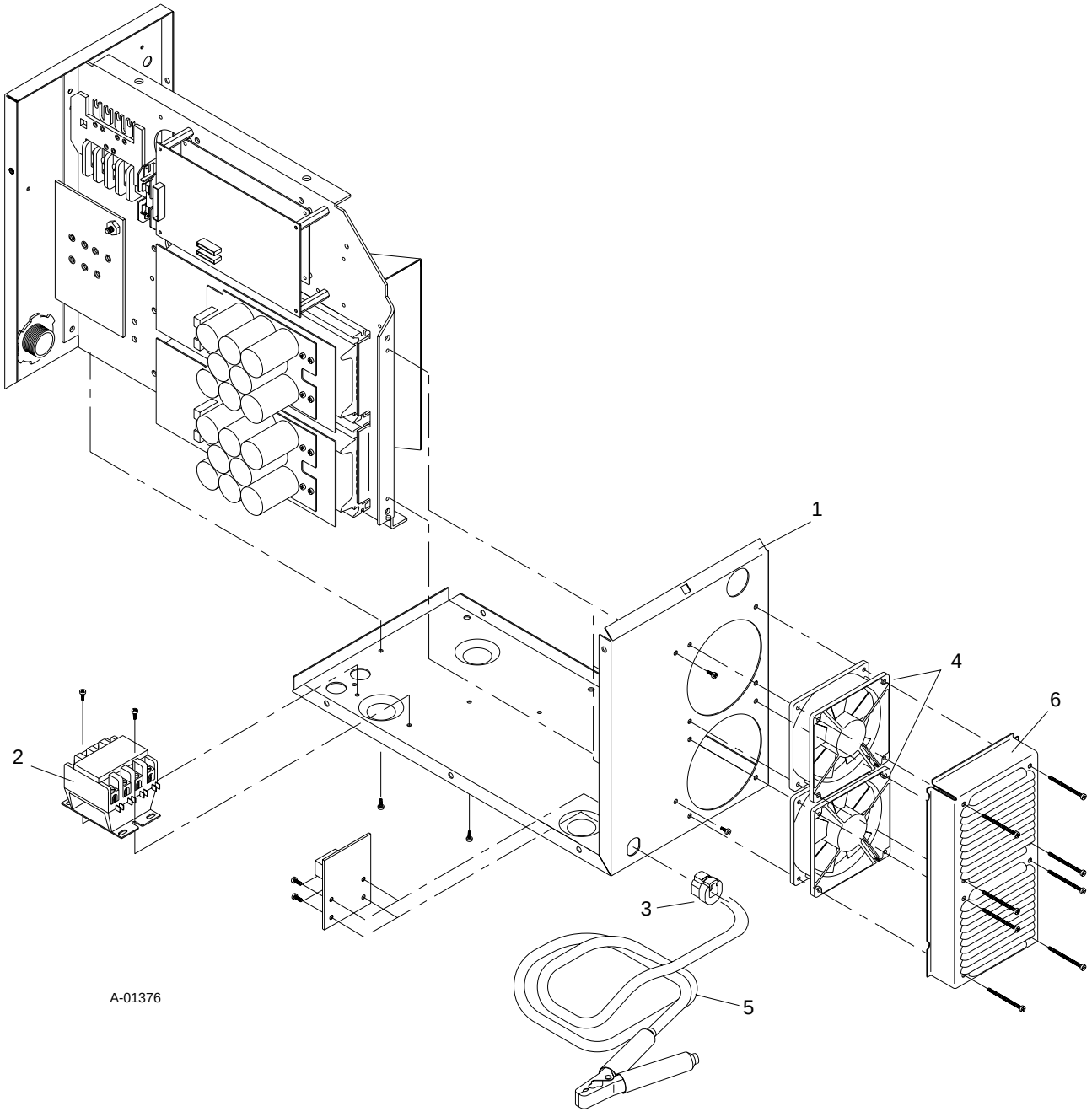
6.05 Front Panel Replacement Parts List

Item #	Qty	Description	Catalog #
1	1	BASE / FRONT, UNIT Includes:	9-7607
		BASE / FRONT, UNIT	
		GROUND TAG	8-4243
		USA LABEL (1 3 / 4 X 3)	8-3216
		OVERLAY, FRONT PANEL	
2	1	CONTACTOR, 4 POLE, 40 FLA, 120 VAC	9-7507
3	1	STRAIN REFIEF - .325-.360 DIA.	8-5537
4	2	FAN, 115V, 50 / 60HZ, 95 / 115CFM W / .187 TABS	8-3209
5	1	CABLE, WORK, #6AWG W / CLAMP, 15'	9-7540
6	1	PANEL, FAN GUARD	9-7620
7	1	ASSEMBLY, CURRENT SENSOR PCB	9-7602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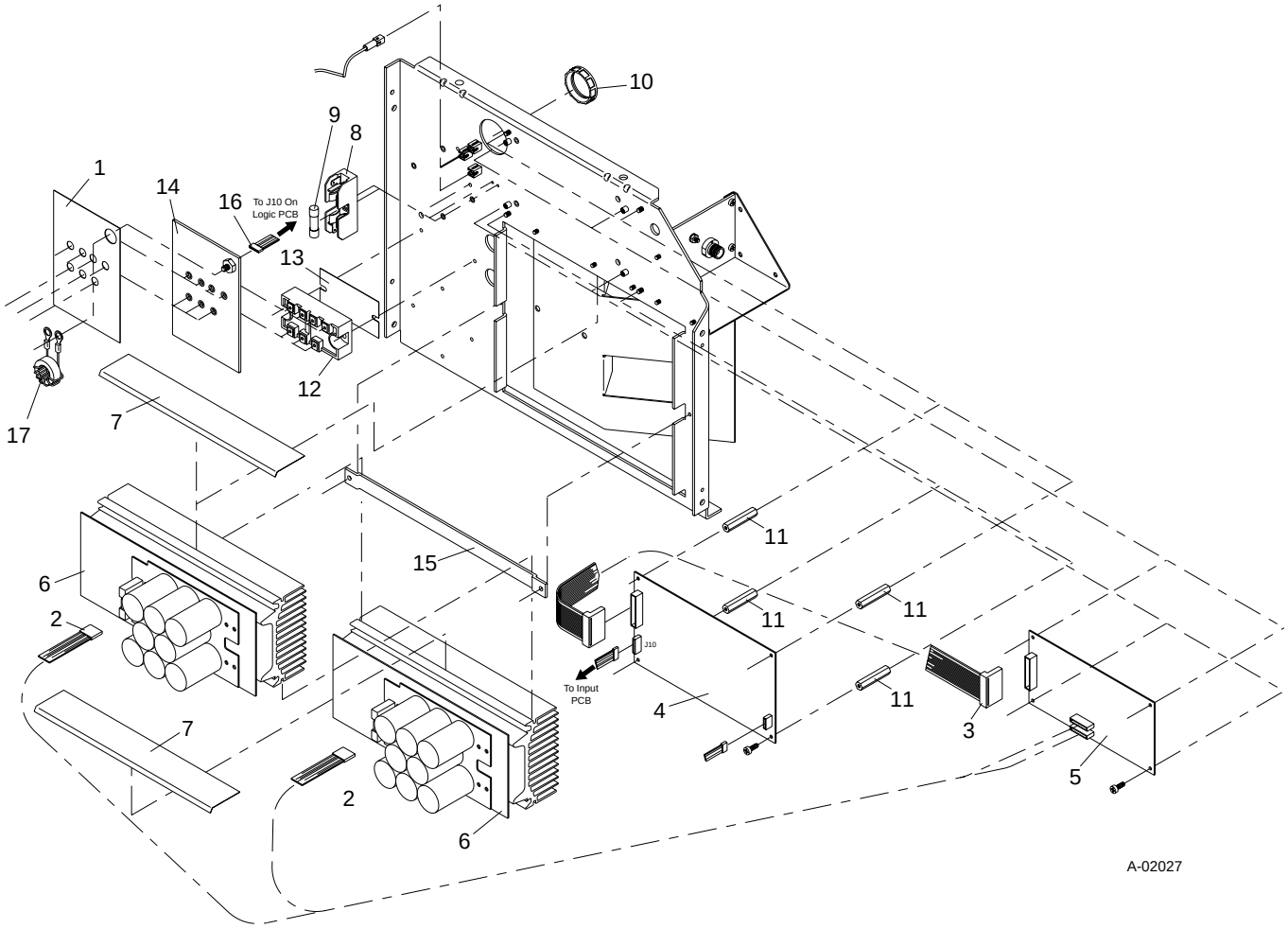
6.06 Left Side Internal Component Replacement Parts List

Item #	Qty	Description	Catalog #
1	1	INSULATOR, INPUT PCB	See Note 1
2	2	CABLE ASSEMBLY, 10 CIR RIBBON, 15"LG	9-5922
3	1	CABLE, 20 CIRCUIT RIBBON	9-7510
4	1	LOGIC CONTROL PCB ASSEMBLY	9-7601
5	1	ASSEMBLY, GATE DRIVER PCB	9-7562
6	2	ASSEMBLY, FET HEATSINK Includes:	9-7015
		ASSEMBLY, FET HEATSINK	
7		DUST COVER, FET ASSEMBLY	
8	1	FUSE BLOCK	9-5562
9	1	FUSE,0.8A 600V, 13/32" DIA	9-7526
10	1	BUSHING	See Note 1
11	4	STANDOFF, #10-32 X 3/8 HEX X 2"LG, AL	See Note 1
12	1	DIODE BRIDGE ASSEMBLY Includes:	9-7604
	1	DIODE BRIDGE, 1600V, 75A	
13		THERMAL PAD, QIII, INPUT MODULE	
14	1	ASSEMBLY, INPUT PCB	9-7600
15	1	BRACKET, HEATSINK MOUNTING	See Note 1
16	1	CABLE, 2 CIRCUIT	See Note 1
17	1	ASSEMBLY, INRUSH CHOKE	9-7616

NOTE 1: Item shown for illustration purposes only.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To J10 On
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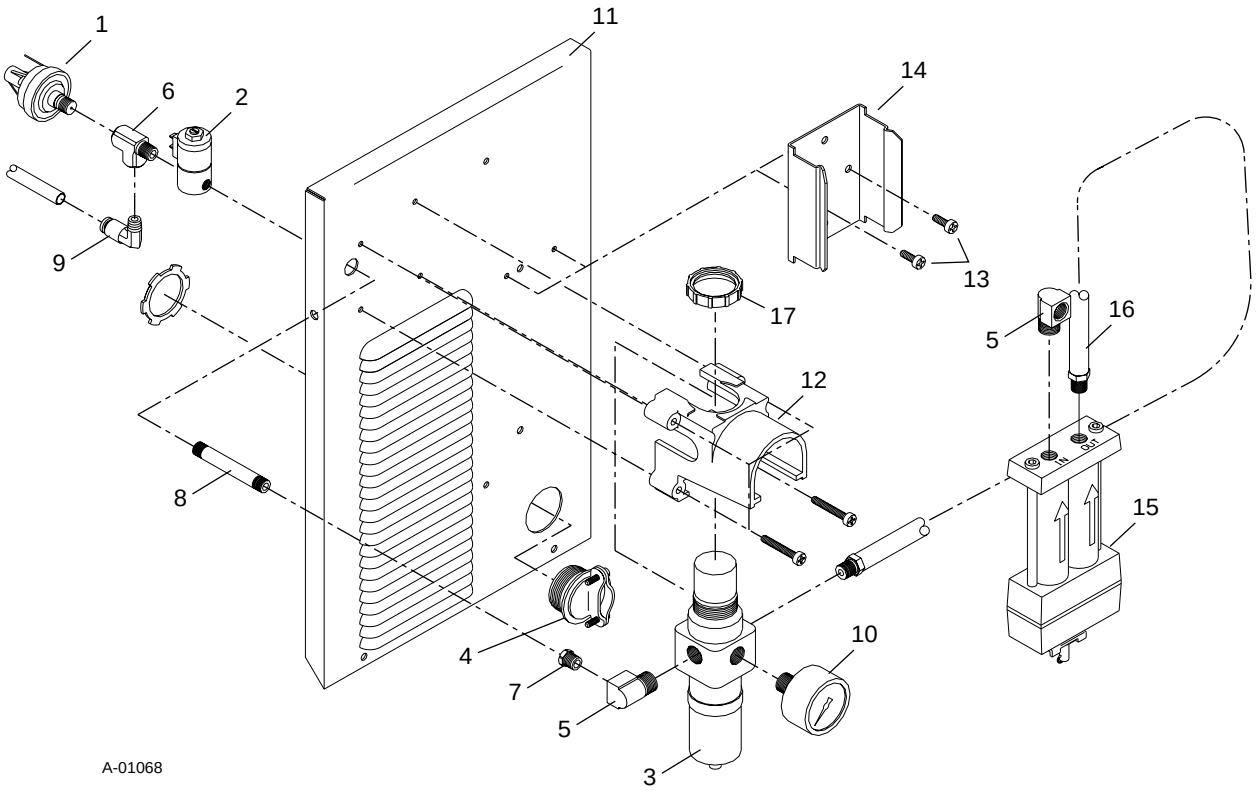
6.07 Rear Panel Replacement Parts List

Item #	Qty	Description	Catalog #
1	1	PRESSURE SWITCH-35 PSI	9-1044
2	1	VALVE, SOLENOID 1/8 NPT	8-3370
3	1	REGULATOR, AIR LINE	9-7514
4	1	FLEX CONNECTOR	8-6307
5	1	1/4 NPT STREET ELBOW	9-2184
6	1	1/8 NPT STR.TEE	8-0352
7	1	1/4-1/8 NPT REDUCER	9-2023
8	1	FITTING, 1/8 NPT X 2" LONG NIPPLE, BRASS	9-7524
9	1	FITTING, 1/8 NPT X 1/4 TUBE 90°	9-7525
10	1	PRESSURE GAUGE	9-1045
11	1	PANEL, REAR Includes: PANEL, REAR LABEL, GAS SUPPLY LABEL, INPUT POWER CONNECTIONS	9-7606
12	1	BRACKET, REGULATOR MOUNTING	9-7589
13	2	10-32X.5 PPH SWAGEFORM STL ZN. PARKER KALON	9-7590
14	1	BRACKET, LAMAN FILTER MOUNTING	9-7535
15	1	TWO STAGE AIR LINE FILTER KIT - OPTIONAL	7-7500
	1	DUAL STAGE AIR FILTER ASSEMBLY	9-1020
	1	REPLACEMENT FIRST STAGE FILTER	9-1021
	1	REPLACEMENT SECOND STAGE FILTER	9-1022
16	1	ASSEMBLY, HOSE, FILTER TO REGULATOR	9-7513
17	1	PANEL MOUNTING NUT	9-5804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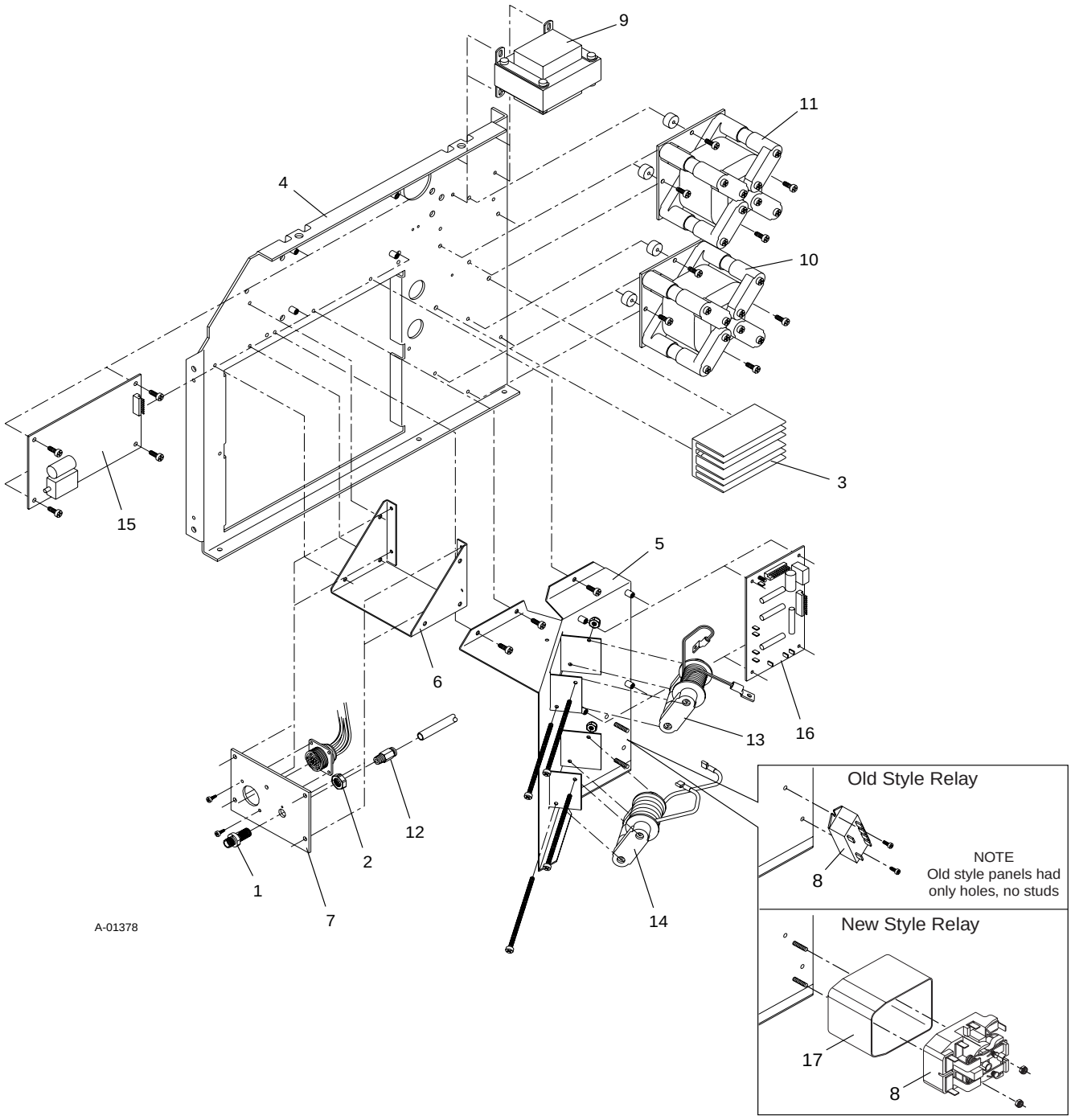
6.08 Right Side Internal Component Replacement Parts List

Item #	Qty	Description	Catalog #
1	1	BULKHEAD ADAPTER, O2B - 1/8 NPT	9-4045
2	2	9/16-1/8 JAM NUT	8-2149
3	1	HEATSINK, INPUT BRIDGE	See Note 1
4	1	CHASSIS, CENTER	See Note 1
5	1	PANEL, PILOT ASSEMBLY MOUNTING	See Note 1
6	1	BRACKET, BULKHEAD MOUNTING	See Note 1
7	1	INSULATOR, BULKHEAD	See Note 1
8	1	PCR Relay	
		Old Style Relay - Use PCR Relay Field Reftrofit Kit	7-3535
		New Style Relay - Use DPST, 20A @ 125VDC, 12VDC COIL	8-3163
9	1	TRANSFORMER, AUX., IEC BOBBIN	9-7541
10	1	ASSEMBLY, MAIN TRANSFORMER	9-7599
11	1	ASSEMBLY, OUTPUT INDUCTOR	9-7598
12	2	FITTING, 1/8 NPT X 1/4 TUBE STR	8-3360
13	1	COIL, CD TRANSFORMER, SECONDARY	9-7597
14	1	COIL, PILOT INDUCTOR	9-7591
15	1	ASS'Y, CD PCB	9-7517
16	1	ASS'Y, PILOT/OUTPUT PCB	9-7518
17	1	DUST COVER, PCR RELAY	8-3164

NOTE 1: Item shown for illustration purposes only.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Old Style Relay
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NOTE
Old style panels had
only holes, no studs
New Style Relay
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6.09 Options and Accessories

Qty	Description	Catalog #
1	Smart Cart	7-7777
	Interface Cable - For Use With Machine Torches Only	
1	25 foot (7.62m)	8-5557
1	50 foot (15.24m)	8-5558
	1 Circle Cutting Attachment	7-7501

APPENDIX I: INPUT WIRING REQUIREMENTS

Input		Power Input (3-Ph)	Current (3-Ph)	Suggested Sizes (See Notes)	
Voltage (Volts)	Freq. (Hz)	(kVA)	(Amps)	Fuse (Amps)	Wire (AWG)
200	50/60	12.8	36.3	45	8
Line Voltages with Suggested Circuit Protection and Wire Sizes Based on National Electric Code and Canadian Electrical Code					

NOTES

Refer to Local and National Codes or local authority having jurisdiction for proper wiring requirements.

Cable size is de-rated based on the Duty Cycle of the equipment.

The suggested sizes are based on flexible power cable with power plug installations. For hard-wired installations refer to local or national codes.

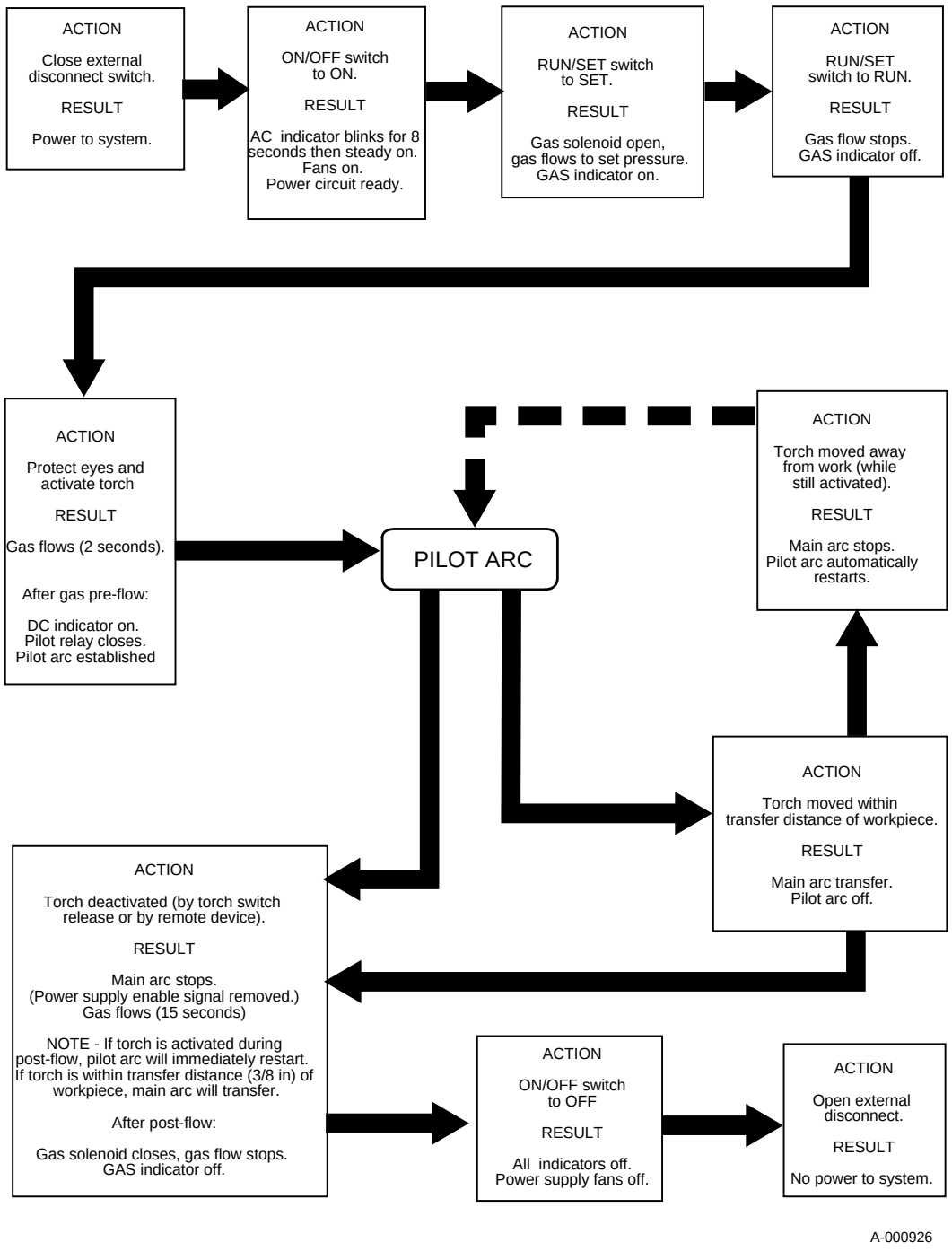
Cable conductor temperature used is 167° F (75° C).

An energy limiting fuse UL Class RK-1 (examples: BUSS LPS/LPN-RK or Gould-Shawmut AZK-A6K) should be used to minimize damage to Plasma Cutting, Welding or power distribution equipment.

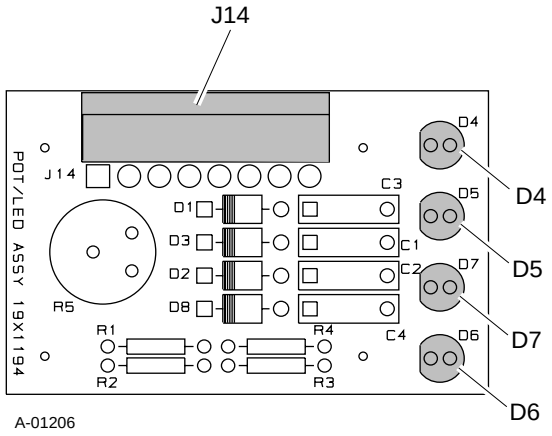
***NEVER** use replaceable element fuses like UL Class H, or "one-time" fuses like UL Class K5.*

Flexible cable must have an outside diameter of 0.69 inches (17.5 mm) or greater.

APPENDIX II: SEQUENCE OF OPERATION (BLOCK DIAGRAM)



APPENDIX III: POT/LED PC BOARD LAYOUT

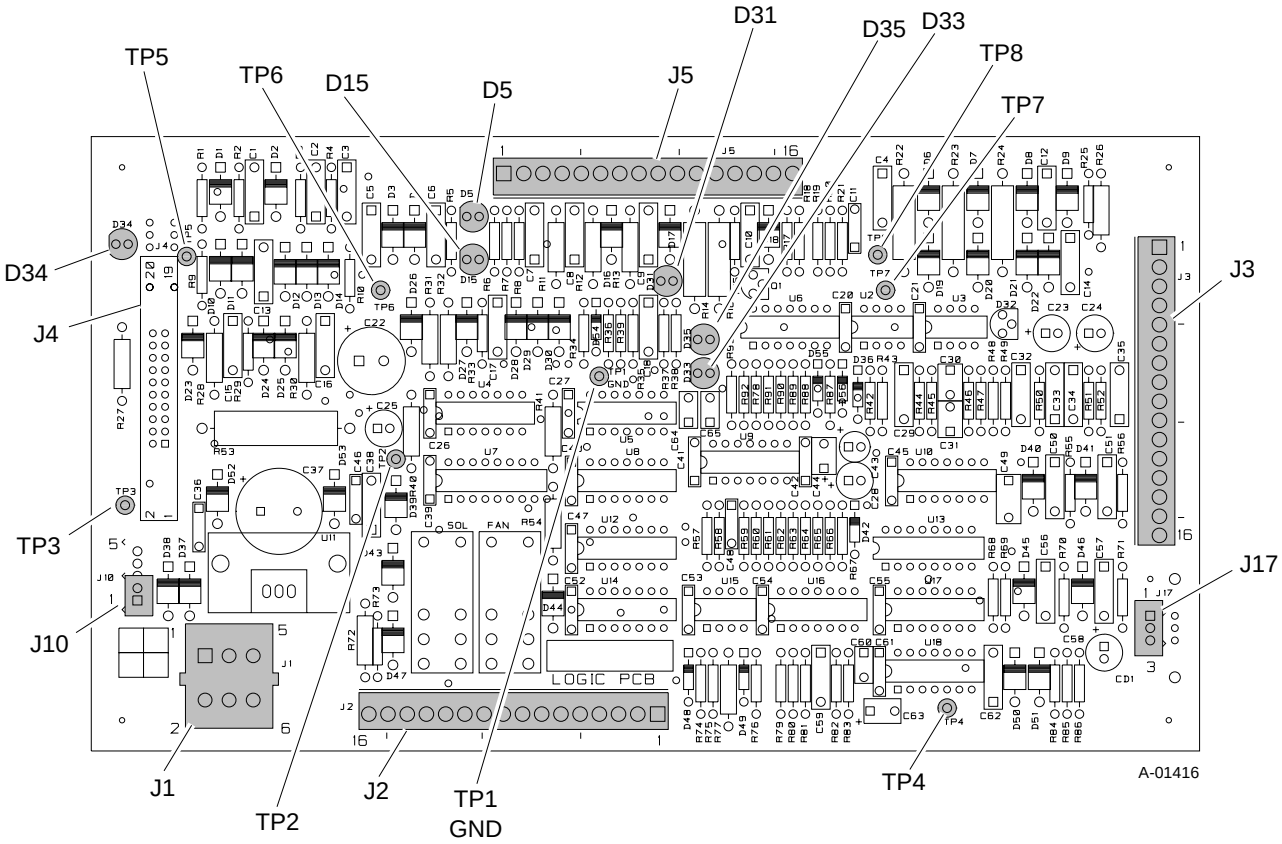


Pot/LED PC Board Signals

J14-1 +10 vdc from Logic PC Board (J3-7)
J14-2 Current Control to Logic PC Board (J3-8)
J14-3 Return for Current Control from Logic PC Board (J3-9)
J14-4 +12 VDC from Logic PC Board (J3-10)
J14-5 Signal for AC OK Indicator to Logic PC Board (J3-11)
J14-6 Signal for GAS Indicator to Logic PC Board (J3-12)
J14-7 Signal for TEMP Indicator to Logic PC Board (J3-13)
J14-8 Signal for DC Indicator to Logic PC Board (J3-14)

D4 Front Panel AC Indicator
D5 Front Panel TEMP Indicator
D6 Front Panel DC Indicator
D7 Front Panel GAS Indicator

APPENDIX IV: LOGIC PC BOARD LAYOUT



Logic PC Board Signals

J1-1	36 VAC from Auxiliary Transformer
J1-2	115 VAC from Auxiliary Transformer
J1-3	Center Tap from Auxiliary Transformer
J1-4	Not Used
J1-5	36 VAC from Auxiliary Transformer
J1-6	115 VAC Return from Auxiliary Transformer
J2-1	115 VAC Return to Contactor
J2-2	115 VAC Return to Fan #1
J2-3	115 VAC Return to Fan #2
J2-4	115 VAC Return to Solenoid
J2-5	Not Used
J2-6	Not Used
J2-7	115 VAC to Contactor
J2-8	115 VAC Return to Fan #1
J2-9	115 VAC Return to Fan #2
J2-10	115 VAC Return to Solenoid
J2-11	Not Used
J2-12	Not Used
J2-13	Pressure Switch Signal
J2-14	Return from Pressure Switch
J2-15	Over Temperature Switch on Input Bridge
J2-16	Over Temperature Switch Return

J3-1	36 VAC to ON / OFF Switch
J3-2	36 VAC from ON / OFF Switch to Logic PC Board
J3-3	36 VAC to ON / OFF Switch
J3-4	36 VAC from ON / OFF Switch to Logic PC Board
J3-5	From RUN / SET Switch on Front Panel
J3-6	From RUN / SET Switch on Front Panel
J3-7	+10 vdc to Front Panel Current Control Pot J14-1
J3-8	From Front Panel Current Control Pot Wiper J14-2
J3-9	To Current Control Pot J14-3 (Return)
J3-10	+18 VDC to Front Panel J14-4
J3-11	Logic Level for AC Indicator on Front Panel (J14-5)
J3-12	Logic Level for GAS Indicator on Front Panel (J14-6)
J3-13	Logic Level for TEMP Indicator on Front Panel (J14-7)
J3-14	Logic Level for DC Indicator on Front Panel (J14-8)
J3-15	Not Used
J3-16	Not Used

J4-1 36 VAC from Gate Driver PC Board (J9-1)
J4-2 36 VAC to Gate Drive PC Board (J9-2)
J4-3 36 VAC from Gate Drive PC Board (J9-3)
J4-4 36 VAC to Gate Drive PC Board (J9-4)
J4-5 Ground to Gate Drive PC Board (J9-5)
J4-6 36 VAC to Gate Drive PC Board (J9-6)
J4-7 Ground to Gate Drive PC Board (J9-7)
J4-8 36 VAC to Gate Drive PC Board (J9-8)
J4-9 Return for Temperature Switch from Gate Drive PC Board (J9-9)
J4-10 Over Temperature Logic Level from Gate Drive PC Board (J9-10)
J4-11 Return for Master Enable Signal from Gate Drive PC Board (J9-11)
J4-12 Logic Level Master Enable Signal to Gate Driver PC Board (J9-12)
J4-13 PWM Enable Return to Gate Drive PC Board (J9-13)
J4-14 Logic Level PWM Enable Signal to Gate Drive PC Board (J9-14)
J4-15 PSR Return from Gate Drive PC Board (J9-15)
J4-16 PSR Signal from Gate Drive PC Board (J9-16)
J4-17 Return for Demand to Gate Drive PC Board (J9-17)
J4-18 Demand Signal to Gate Drive PC Board (J9-18)
J4-19 Return for Demand to Gate Drive PC Board (J9-19)
J4-20 Not Used

J5-1 36 VAC to CD PC Board (J11-1)
J5-2 Return to CD PC Board (J11-2)
J5-3 36 VAC to CD PC Board (J11-3)
J5-4 CD Enable Signal to CD PC Board (J11-4)
J5-5 CD Enable Return to CD PC Board (J11-5)
J5-6 +18 vdc to PCR Relay
J5-7 PCR Signal to PCR Relay
J5-8 Torch Switch to Pilot / Output PC Board (J13-1)
J5-9 Torch Switch Return to Pilot / Output PC Board (J13-2)
J5-10 OK-To-Move Signal to Pilot / Output PC Board (J13-4)
J5-11 +18 vdc to Pilot / Output PC Board (J13-3)
J5-12 Return
J5-13 Not Used
J5-14 From Pilot / Output PC Board to Sense Drag Cutting
J5-15 Not Used
J5-16 From Pilot / Output PC Board to Sense DC

J10-1 Inrush Signal to Input PC Board (J16-1)
J10-2 +18 VDC to Input PC Board for Relays (J16-2)

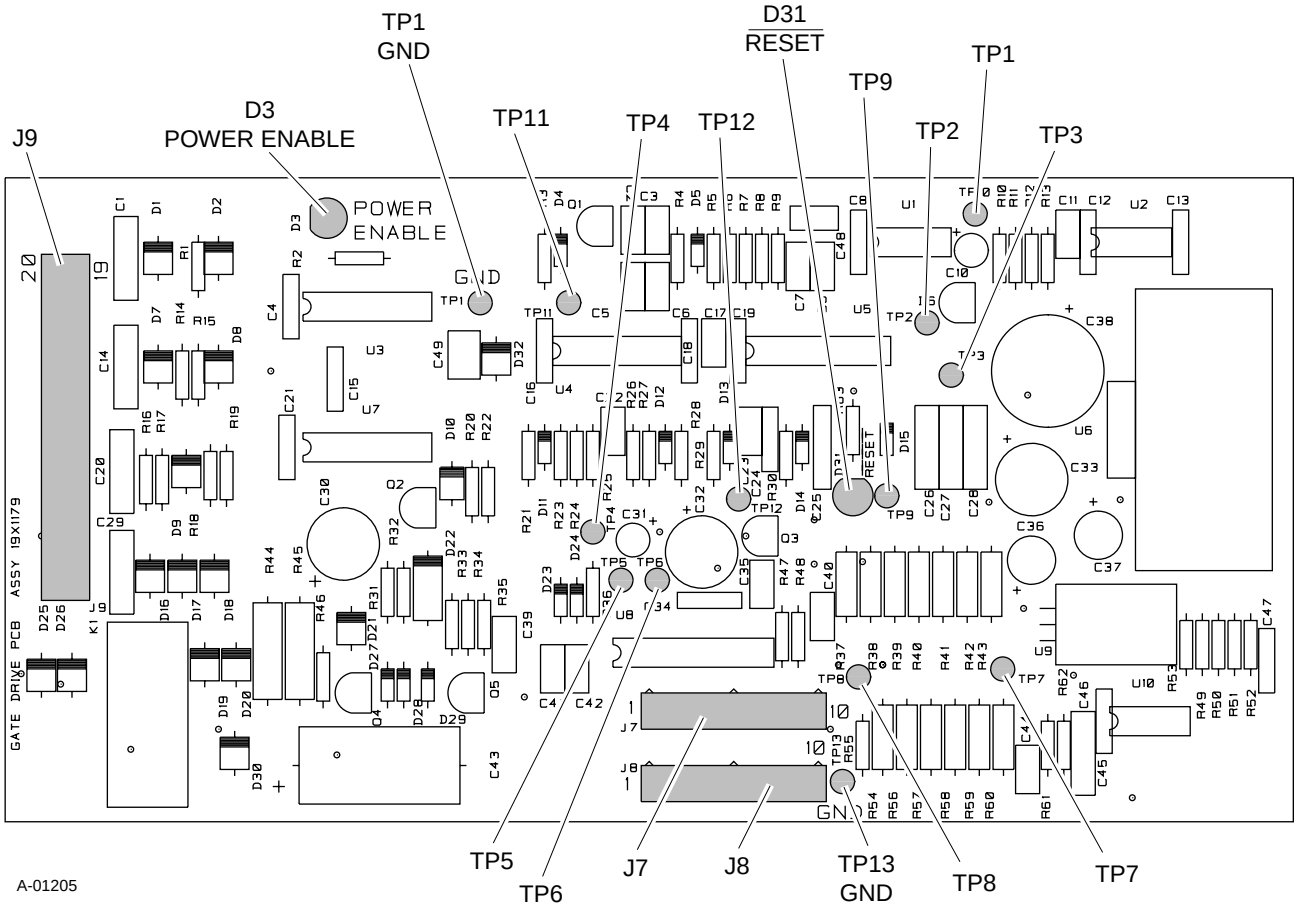
J17-1 CSR Signal from Current Sensor
J17-2 Return for CSR Signal
J17-3 +120 VDC to Current Sensor

TP1 Logic Ground
TP2 +18 VDC

TP3 +18 VDC
TP4 Not Used
TP5 Not Used
TP6 +12 VDC
TP7 Not Used
TP8 Not Used (On Newer PC Boards Only)

D5 Torch Switch Enable Indicator
D15 CD Enable Indicator
D31 CSR Indicator
D33 Pilot On Indicator
D34 AC OK Indicator
D35 Drag On Indicator

APPENDIX V: GATE DRIVE PC BOARD LAYOUT



Gate Drive PC Board Signals

J7-1 +12 VDC to FET PC Boards (J6-1)
J7-2 Return for +12 VDC to FET PC Boards (J6-2)
J7-3 PWM Output (A) to FET PC Boards (J6-3)
J7-4 PWM Return to FET PC Boards (J6-4)
J7-5 Primary Current Sense from FET PC Boards (J6-5)
J7-6 Primary Current Sense Return from FET PC Boards (J6-6)
J7-7 Secondary Current Sense from FET PC Boards (J6-7)
J7-8 Secondary Current Sense Return from FET PC Boards (J6-8)
J7-9 Over Temperature Sense from FET PC Boards (J6-9)
J7-10 Over Temperature Sense from FET PC Boards (J6-10)

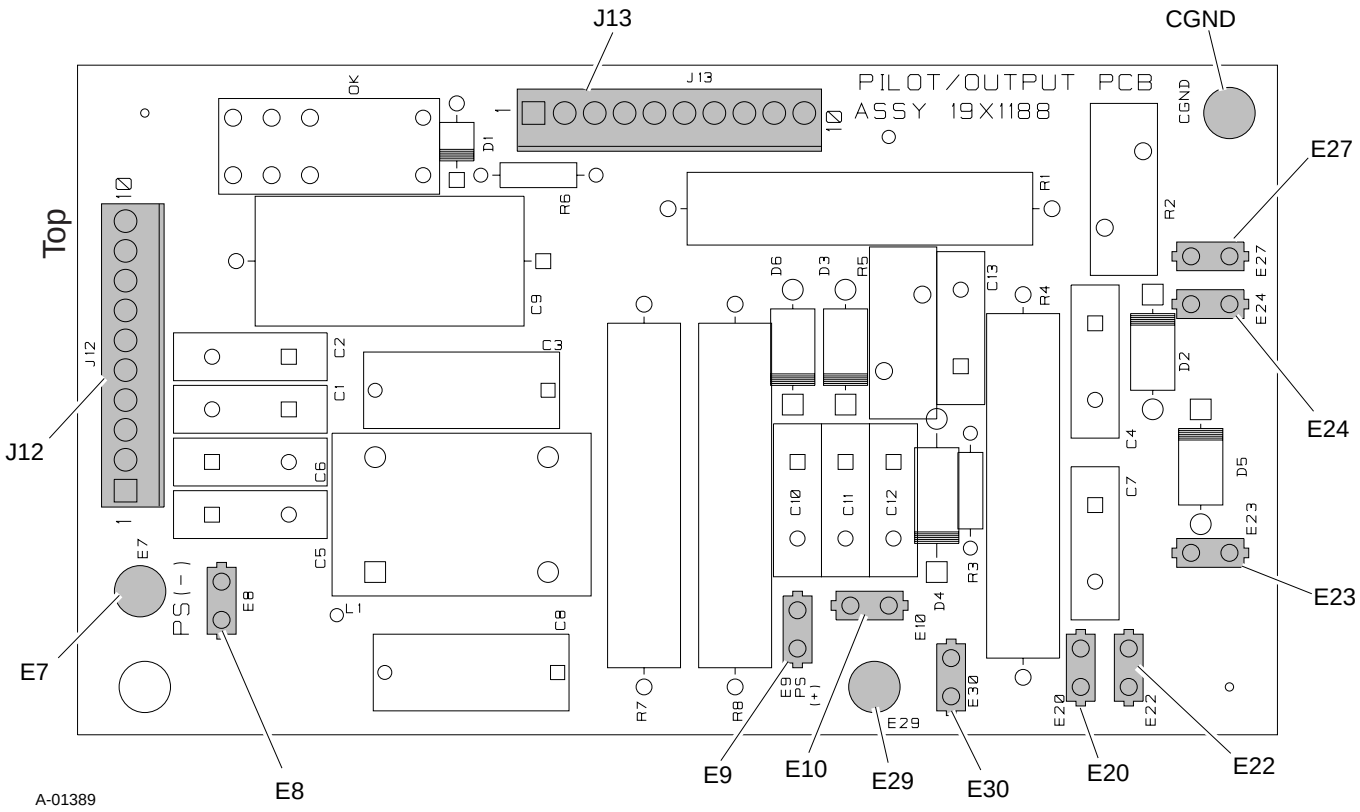
J8-1 +12 VDC to FET PC Boards (J6-1)
J8-2 Return for +12 VDC to FET PC Boards (J6-2)
J8-3 PWM Output (A) to FET PC Boards (J6-3)
J8-4 PWM Return to FET PC Boards (J6-4)
J8-5 Primary Current Sense from FET PC Boards (J6-5)
J8-6 Primary Current Sense Return from FET PC Boards (J6-6)
J8-7 Secondary Current Sense from FET PC Boards (J6-7)
J8-8 Secondary Current Sense Return from FET PC Boards (J6-8)
J8-9 Over Temperature Sense from FET PC Boards (J6-9)
J8-10 Over Temperature Sense from FET PC Boards (J6-10)

J9-1 36 VAC from Logic PC Board (J4-1)
J9-2 36 VAC from Logic PC Board (J4-2)
J9-3 36 VAC from Logic PC Board (J4-3)
J9-4 36 VAC from Logic PC Board (J4-4)
J9-5 Return from Logic PC Board (J4-5)
J9-6 36 VAC from Logic PC Board (J4-6)
J9-7 Return from Logic PC Board (J4-7)
J9-8 36 VAC from Logic PC Board (J4-8)
J9-9 Over Temperature Sense from FET PC Boards to Logic PC Board (J4-9)
J9-10 Over Temperature Sense from FET PC Boards Boards to Logic PC Board (J4-10)
J9-11 Return for Master Enable Signal to Logic PC Board (J4-11)
J9-12 Master Enable Signal from Logic PC Board (J4-12)
J9-13 Return for PWM Enable Signal to Logic PC Board (J4-13)
J9-14 PWM Enable Signal from Logic PC Board (J4-14)
J9-15 Return for PSR Signal from Logic PC Board (J4-15)
J9-16 PSR Signal to Logic PC Board (J4-16)
J9-17 Return for Demand Signal to Logic PC Board (J4-17)
J9-18 Demand Signal from Logic PC Board (J4-18)
J9-19 Return for Demand Signal from Logic PC Board (J4-19)
J9-20 Not Used

TP1 Logic Ground
TP2 +12 VDC
TP3 -12 VDC
TP4 +5 VDC
TP5 Not Used
TP6 Not Used
TP7 Not Used
TP8 Not Used
TP9 Not Used
TP10 +6 VDC
TP11 Not Used
TP12 Not Used
TP13 Not Used

D3 Power Enable Indicator
D31 Reset Indicator

APPENDIX VI: PILOT OUTPUT PC BOARD LAYOUT



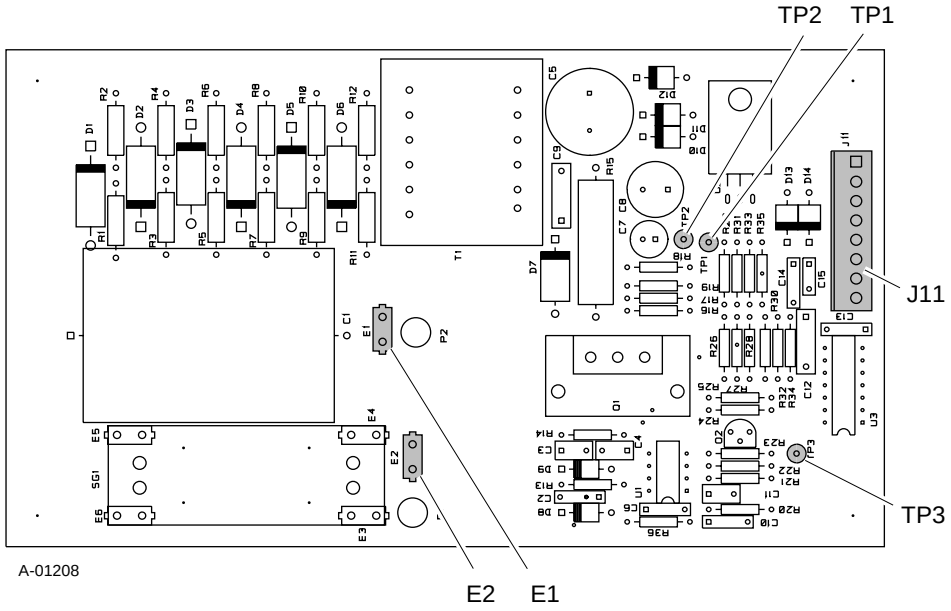
Pilot Output PC Board Signals

J12-1 Torch Switch Filter in from J22-3 Torch Control
J12-2 Not Used
J12-3 Torch Switch Filter Return from J22-4 Torch Control
J12-4 Not Used
J12-5 Pilot Return Shield to J22-1 Torch Control
J12-6 Torch Switch Shield to J22-2 Torch Control
J12-7 Not Used
J12-8 OK to Move TO J22-12 Torch Control OK to Move
J12-9 Not Used
J12-10 OK to Move RTN TO J22-14 Torch Control OK to Move RTN

J13-1 Torch Switch Filter out to J5-8 Logic Board Torch Sw
J13-2 Torch Switch Filter gnd out to J5-9 Logic Board Torch Sw gnd
J13-3 OK to Move Relay Coil to Logic PCB J5-10 OK to Move
J13-4 OK to Move Relay Coil to Logic PCB J5-11 +25V
J13-5 PS(+) to Logic Board J5-12 Output Sense Gnd
J13-6 Not Used
J13-7 Tip Voltage Sense to Logic Board J5-14 Drag Sense
J13-8 Not Used
J13-9 PS(-) Sense to Logic Board J5-16 PS(-) Sense (DC and Off the Plate)
J13-10 Not Used

CGND	Chassis Gnd
E7	PS(-) (Stud) from Output Inductor L1 to CD Xfmr
E8	PS(-) C4 Rtn for Pilot Voltage Twisted with Pilot RTN to E23
E9	PS(+) to E18 Upper Fet Module
E10	PS(+) to E18 Upper Fet Module
E20	From E22 to PCR Pin 2
E22	From Pilot Choke to E20
E23	C4 Rtn for Pilot Voltage Twisted with Pilot RTN from E8
E24	Pilot RTN from Standoff on bulk head and Torch Cable
E27	Pilot RTN to Pilot Choke
E29	PS(+) (Stud) from Work lead Through Current Sense To E18 Fet Modules
E30	PS(+) to CSR 8

APPENDIX VII: CD PC BOARD LAYOUT



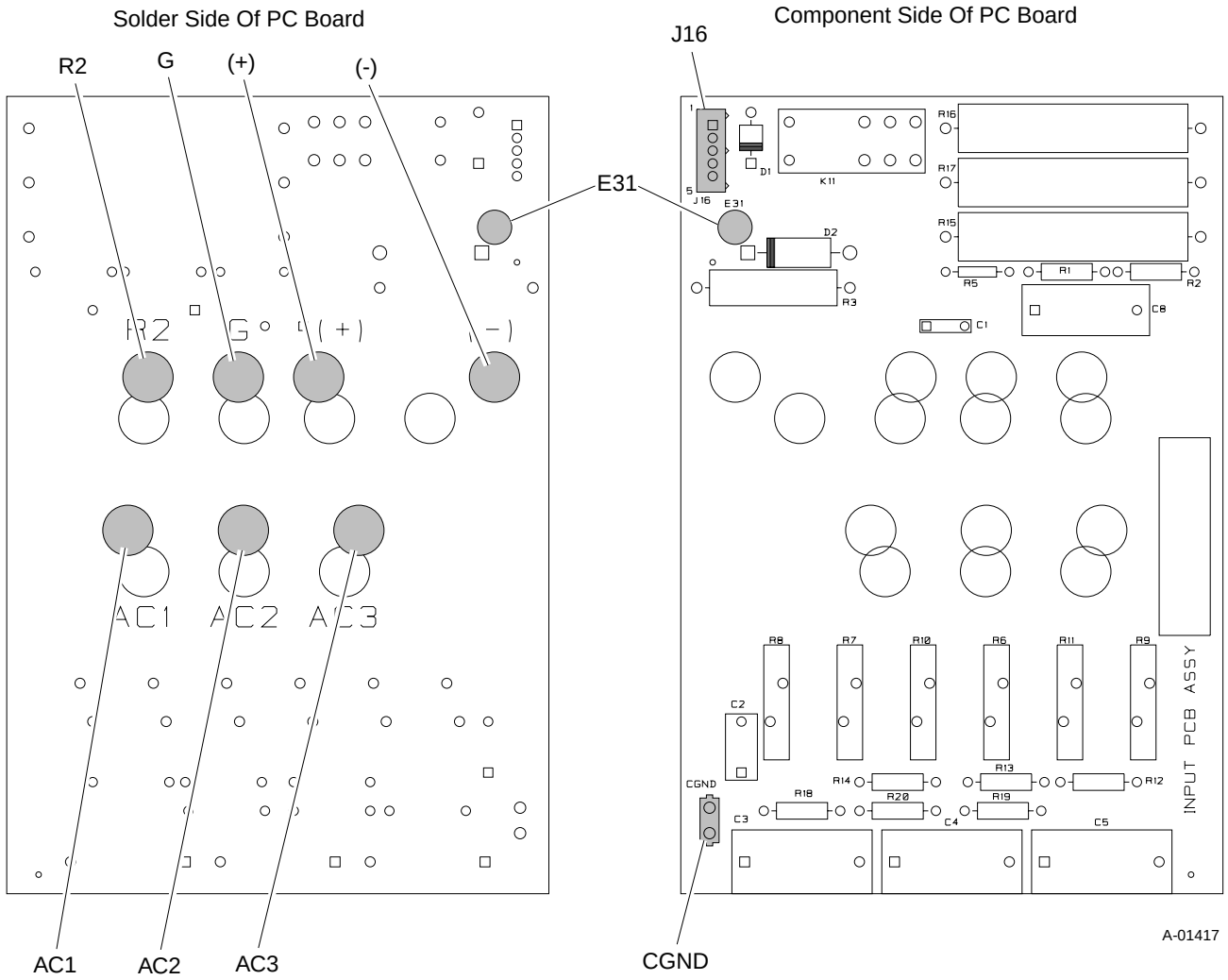
CD PC Board Signals

J11-1 36 VAC from Logic PC Board (J5-1)
J11-2 Return from Logic PC Board (J5-2)
J11-3 36 VAC from Logic PC Board (J5-3)
J11-4 CD Enable Signal from Logic PC Board (J5-4)
J11-5 Return for CD Enable Signal from Logic PC Board (J5-5)
J11-6 Not Used
J11-7 Not Used
J11-8 Not Used

TP1 Logic Ground or Return
TP2 +12 VDC
TP3 Not Used

E1 CD output
E2 CD Output

APPENDIX VIII: INPUT PC BOARD LAYOUT

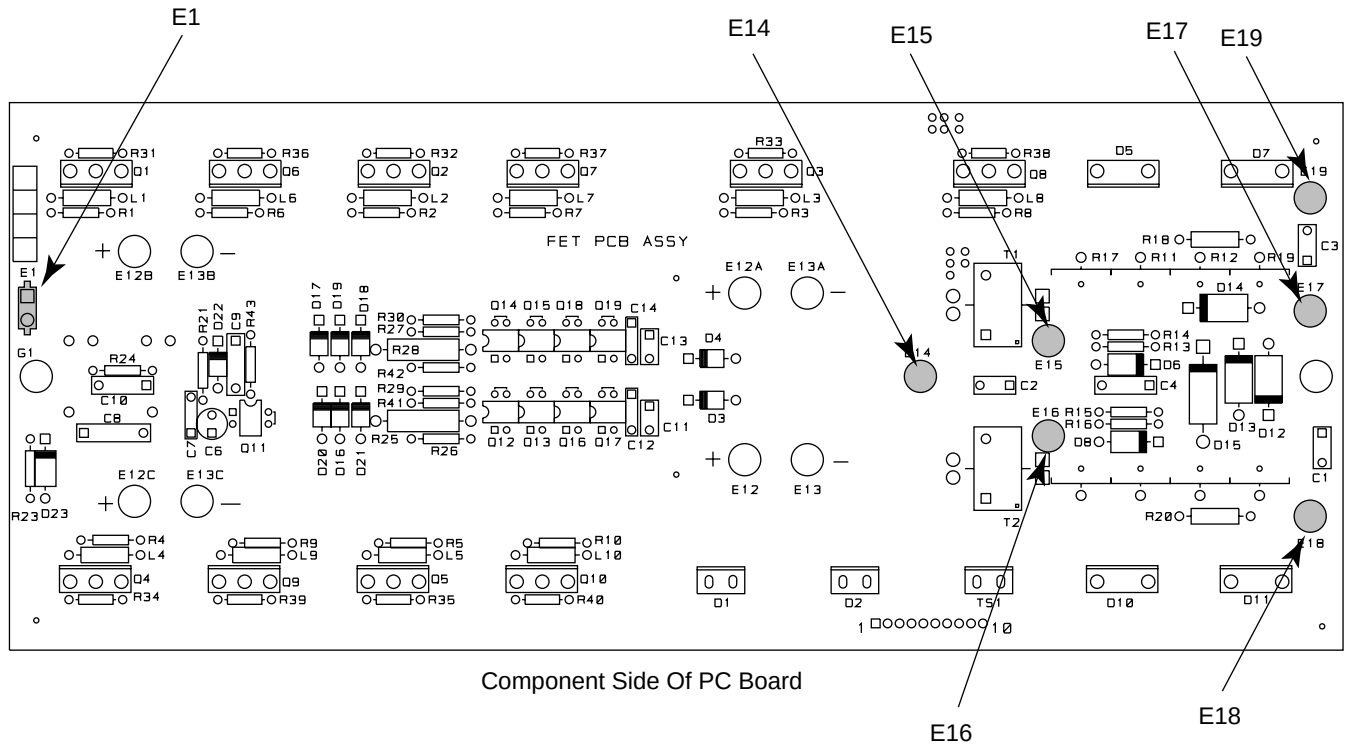


Input PC Board Signals

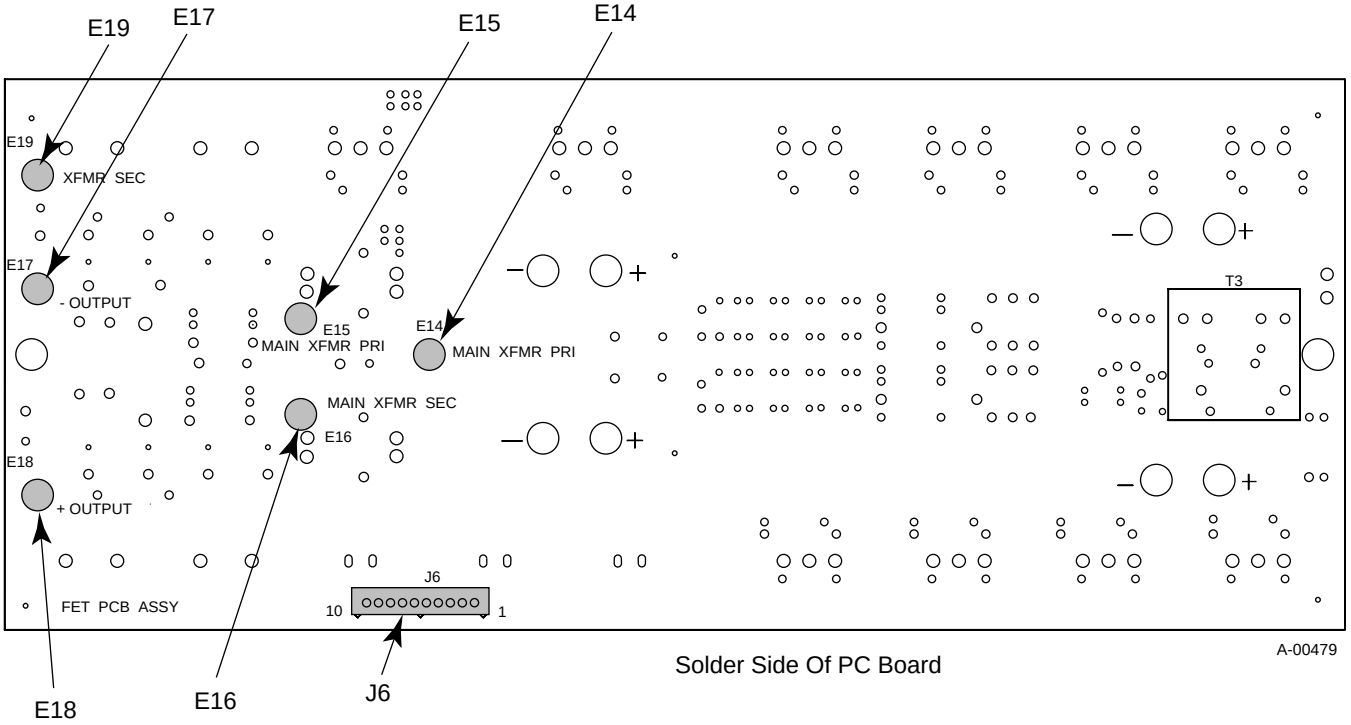
J16-1 Gate Drive Relay Rtn from Logic Board J10-1
J16-2 Gate Drive Relay Pos from Logic Board J10-2
J16-3 Not used
J16-4 Not used
J16-5 Not used

CGND Chassis Ground to Chassis Ground
R2 Rectifier (+) to Rectifier (+)
G SCR Gate to SCR Gate
(+) SCR Cathode Module (+) Output to the Inrush Choke Assembly
(-) Rectifier (-) Module (-) Output to the Cap Board (-) E26
AC1 AC Input Phase 1 from the contactor T1 and T4
AC2 AC Input Phase 2 from the contactor T2
AC3 AC Input Phase 3 from the contactor T3
E31 Output from Inrush Choke Assembly to Cap Board (+) E25

APPENDIX IX: FET PC BOARD LAYOUT



Component Side Of PC Board



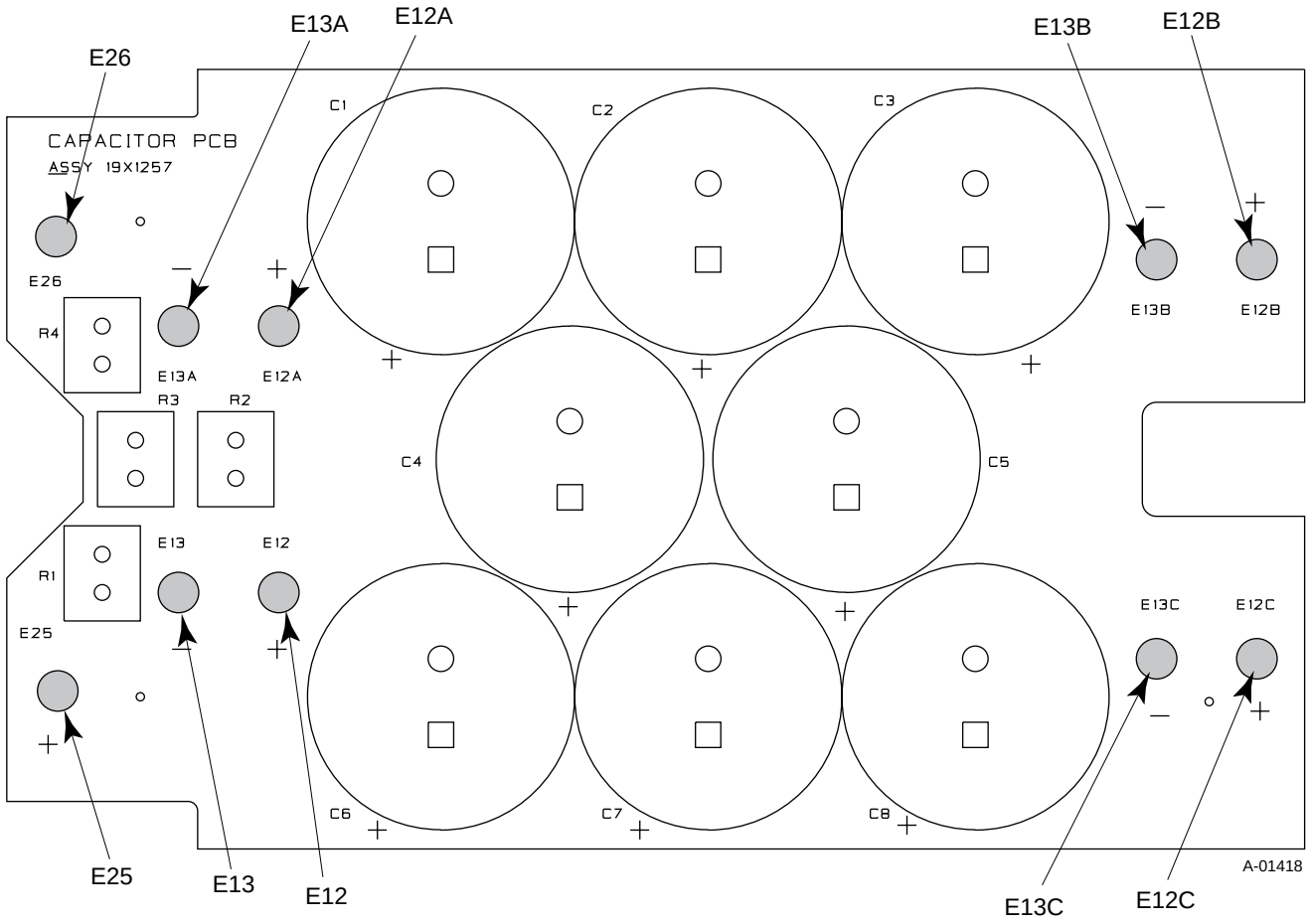
Solder Side Of PC Board

FET PC Board Signals (Upper and Lower Assemblies)

J6-1 +12V from the Gate Drive Board upper J7-1 Lower J8-1
J6-2 +12V RTN from the Gate Drive Board upper J7-2 Lower J8-2
J6-3 Pwm Output from the Gate Drive Board upper J7-3 Lower J8-3
J6-4 Pwn Output RTN J6-2 from the Gate Drive Board upper J7-4 Lower J8-4
J6-5 PRI CURRENT SENSE to the Gate Drive Board upper J7-5 Lower J8-5
J6-6 PRI CURRENT SENSE RTN to the Gate Drive Board upper J7-6 Lower J8-6
J6-7 SEC CURRENT SENSE to the Gate Drive Board upper J7-7 Lower J8-7
J6-8 SEC CURRENT SENSE RTN to the Gate Drive Board upper J7-8 Lower J8-8
J6-9 OVER TEMP RTN to the Gate Drive Board upper J7-9 Lower J8-9
J6-10 OVER TEMP to the Gate Drive Board upper J7-10 Lower J8-10

E1 HEATSINK GND To HEAT SINK
E14 MAIN XFMR PRI to MAIN XFMR PRI E14
E15 MAIN XFMR PRI to MAIN XFMR PRI E15
E16 MAIN XFMR SEC from MAIN XFMR SEC E16
E17 OUTPUT (-) to OUTPUT INDUCTOR L1
E18 OUTPUT (+) to Current Sense Transformer, E9 on Output Board, and pin 8 PCR
E19 MAIN XFMR SEC from MAIN XFMR SEC E19

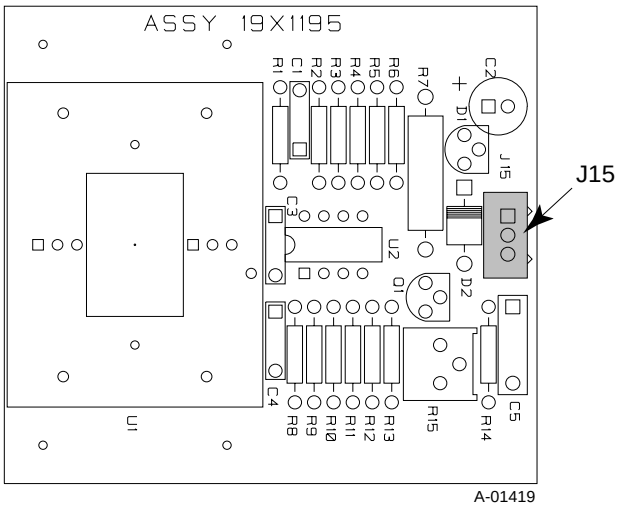
APPENDIX X: CAPACITOR PC BOARD LAYOUT



Capacitor PC Board Signals

E12 Positve Rail to FET Board
E12A Positve Rail to FET Board
E12B Positve Rail to FET Board
E12C Positve Rail to FET Board
E13 Negative Rail to FET Board
E13A Negative Rail to FET Board
E13B Negative Rail to FET Board
E13C Negative Rail to FET Board
E25 Positive Input from Input Board (+) SCR Cathode
E26 Negative Input from Input Board (-) Rectifier (-)

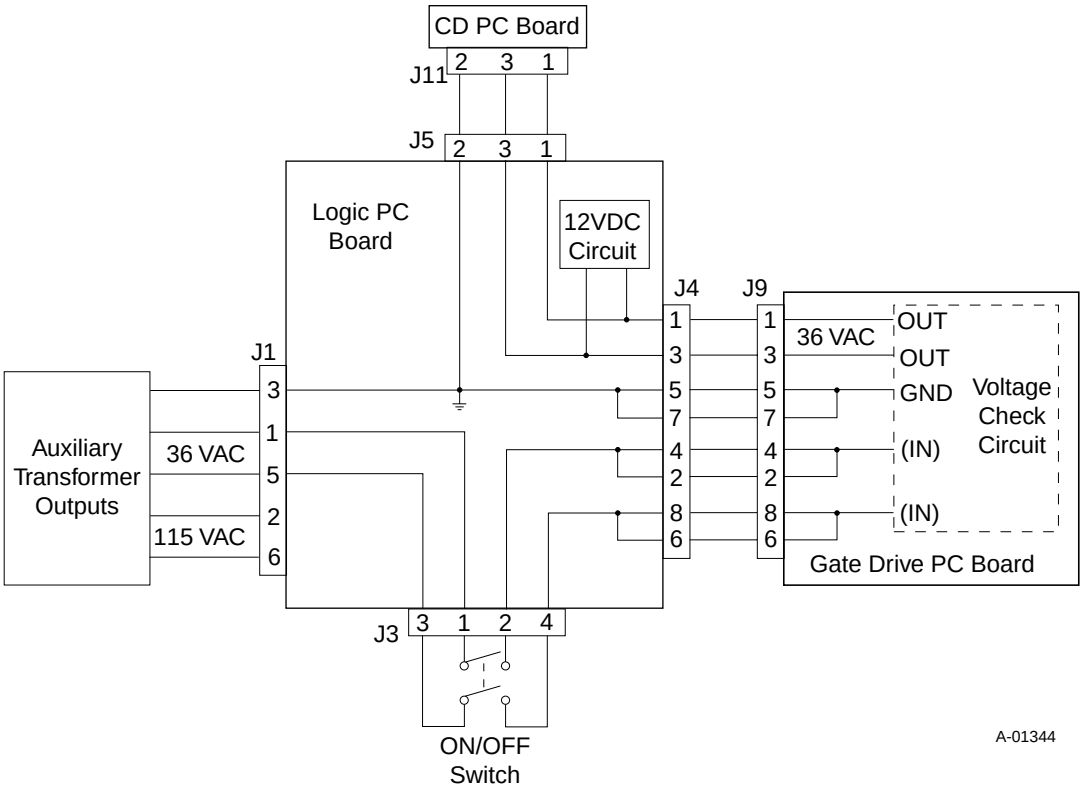
APPENDIX XI: CURRENT SENSOR PC BOARD LAYOUT



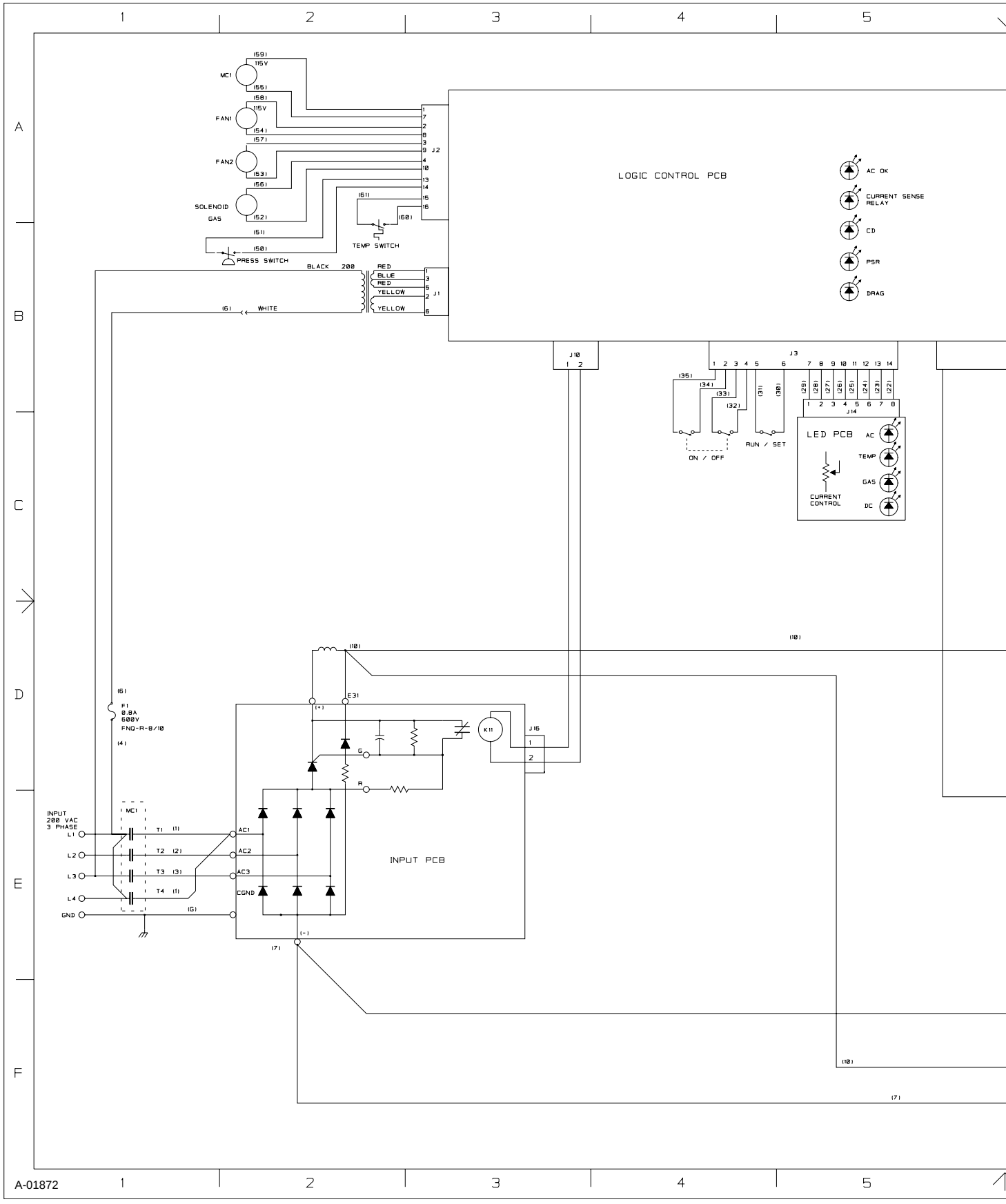
Current Sensor PC Board Signals

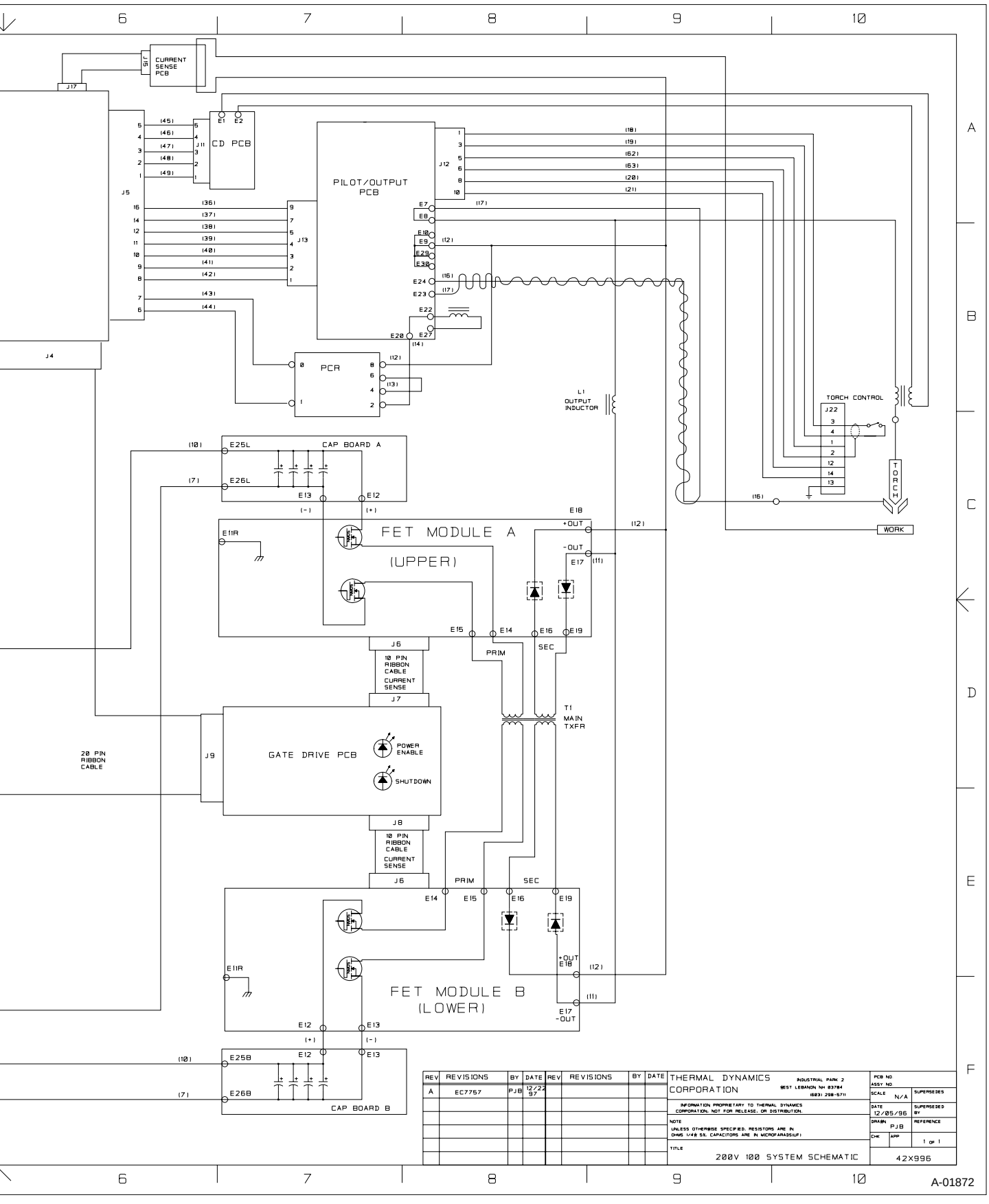
J15-1 Work Cable Sense
J15-2 Ground
J15-3 +12 VDC

APPENDIX XII: 36VAC CIRCUIT DIAGRAM



APPENDIX XIII: SYSTEM SCHEMATIC




CURRENT SENSE PCB
CD PCB
PILOT/OUTPUT PCB
PCR
L1 OUTPUT INDUCTOR
TORCH CONTROL
TORCH
WORK
CAP BOARD A
CAP BOARD B
FET MODULE A (UPPER)
FET MODULE B (LOWER)
10 PIN RIBBON CABLE CURRENT SENSE
20 PIN RIBBON CABLE
GATE DRIVE PCB
POWER ENABLE
SHUTDOWN
T1 MAIN TXFR
PRIM
SEC
+OUT
-OUT
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200V 100 SYSTEM SCHEMATIC
42X996
12/05/96
PJB
N/A
1 OF 1
A-01872